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ELEKTROTECHNISCHE ZEITSCHRIFT.

The prediction we made in our issue of June 9, p. 790, that Mr. Gisbert Kapp, formerly of London, would assume the editorial management of this leading German electrical journal, has turned out to be correct. In the issue of the journal just received, it is announced that he and Mr. Jul. H. West, will hereafter be the editors. We congratulate our esteemed contemporary on the acquisition of this noted engineer and writer as its editor, and are sure that the value of the journal will thereby be greatly increased. No marked change seems to have been made under the new management, with the exception of the introduction of a department corresponding to the editorial comments in American and English papers, a department, which, strange to say, does not exist in any other French or German journal. This new department, representing chiefly the opinions of Mr. Kapp, will form an additional interesting feature of that journal.

L'ENERGIE ELECTRIQUE.

A new journal with this title has just been started in Paris. Electricity is already represented in that country by a sufficient number of journals and the introduction of a new one would not be advisable were it not for the fact that the editors in this one have wisely limited themselves to a special branch. It is their intention to make this "an organ for central station operators, consumers and municipalities," although they intend also to undertake the difficult task of keeping the public posted on all that pertains to the electrical industry, employing for this purpose semi-popular language. Although the subject of central stations in that country is already covered very well by its older contemporary, *L'Industrie Electrique*, there may be a sufficiently large field for the success of a new journal; at all events it has our best wishes for its success. The editors have, strange to say, forgotten to state whether it is to be a weekly or a monthly, but judging from the price, which is not low, it will probably be a weekly.

PHASE REGULATION.

One of the difficulties encountered in alternate current working is the shifting of the phase between the voltage and the current when a circuits contain self-induction, thus producing a wasteful "wattless" current. This difficulty is especially noticeable in alternating current power transmission, and in a certain large installation it interfered so much that the plant could not be run economically. The insertion of an over-excited synchronous motor in the circuit was suggested and, as is shown in the Digest this week, this remedy was applied to the unsuccessful plant just mentioned, after which it ran very satisfactorily and economically, thus affording a practical proof of the theory. From this it would appear to be quite safe to adopt this remedy, The case referred to was a three-phased transmission plant, but in a single-phased synchronous system the motor itself may be made to overcome the difficulty by simply over-exciting it, thus forming an apparently paradoxical system in which the motor has a higher counter E. M. F. than the voltage of the generator. Already modifications are suggesting themselves, one of which was described in the Digest last week, in which the continuous current exciter was made to take the part of a special machine for overcoming the difficulty due to phase shifting.

THE STREET RAILWAY CONVENTION.

The great success of the recent Convention of the American Street Railway Association at Atlanta completes the record which gives to the year 1894 the distinction of being a period of phenomenal professional activity, if the interest taken in the meetings of the

various electrical associations can be accepted as a criterion. The social side of the convention was a decided success, and fully justified the stress laid upon this feature in the preliminary announcement of the secretary. Not less so was the part of the commercial programme that received its realization in the exhibition in the Machinery Hall, and the appreciation so fully expressed in regard to the value of this department will doubtless hereafter render it the object of more attention than it has sometimes received in the past. Last, but by no means least, is the full programme of professional papers. While these did not receive at the meeting the attention merited, yet this could scarcely be otherwise in view of the limited duration of the sessions and the great demands from other directions on the time of the delegates. This, however, detracts very little from the value of this part of the programme, as the papers will later receive the mature consideration which it would be impossible under the most favorable conditions to give at a convention. On the other hand, the lack of discussion is to be regretted, but it is possible to make amends for this by encouraging written communications on the various papers, to be subsequently published in the annual report of the Association. While these would thus be lacking some of the merits of discussions at the meetings, yet this would probably be more than compensated for by the more careful thought that would be given to the subject considered, and have the incidental advantage of allowing the editor to use his blue lead pencil —which prerogative might sometimes be more freely exercised under the present conditions than has been done. Of the many papers read those of Messrs. Bettis and Harrington are of particular interest. The proper classification of steel railway accounts is a matter of importance aside from its value in the management of companies. The engineer in studying the best disposition of the various factors that enter into the design of a plant, with a view to the highest economy in subsequent operations, is frequently much handicapped for data, which the system proposed would go far toward supplying. It will also furnish a means of comparison for street railway managers with other plants, and thus enable him to discover under which head there is a probability for a reduction in expense. The investigation of Mr. Harrington is an interesting one, and brings out strongly the fact that the controlling factor in the use of fuses is not the capacity of the fuse as much as the carrying capacity, so to speak, of the arc which may follow when the fuse is "blown." The use of Mr. W. S. Barstow's "booster" system for use with electric railways, as advocated by Messrs. Vail and Wynkoop, brings up an interesting question, and the great claim of efficiency made will doubtless cause the matter to be carefully considered by engineers. It seems hardly probable, however, that under the conditions of actual street railway operation the theoretical conditions assumed by the authors of the paper in their calculations for efficiency can be realized, as the continuous operation of the railway motor at a high efficiency is implied, which is far from being the case in practice.

NATIONAL LABORATORIES.

Although America is justly given the credit of being usually ahead of other nations in the introduction of anything new, yet in some respects, we regret to say, the American government is far behind the governments of the other large nations. One notable instance is in the total absence of a national electrical laboratory for the purpose of making, preserving and comparing the national electrical standards and for enabling anyone for a reasonable fee to have his secondary standards, measuring instruments or meters, duly compared and calibrated and marked with an official stamp, carrying with it the guarantee of the government that the instrment either reads correctly or that its error is so-and-so much. The only ways in which a person who has no facilities himself, can now have an instrument or standard compared and calibrated, is either to send it abroad, which one would naturally dislike to do, or have it done by some expert or at some university. The latter is the course generally pursued here, but it is evident that no matter how good the authority, it does not carry nearly the weight of a government guarantee, nor can any expert or university afford to make a business of such work without going to an expense which would involve such high fees that comparatively few could avail themselves of such an opportunity. Besides, there would not be the necessary uniformity in the calibrations, as there would doubtless be a difference in the standards of different parties, at least when it concerns very accurate work. Whether the government standards are exactly right or not, would not be so serious, as long as all standards in use in this country were based on them. The government would, furthermore, have an opportunity to compare its standards with those of other countries, a privilege which no expert or private institution could obtain. Among the national laboratories in Europe, Germany leads with its excellent Reichsanstalt, until recently under the leadership of von Helmholtz. England is now installing its Board of Trade Laboratory, a government institution, although having a much more limited scope than the German Reichsanstalt. France has its Laboratoire Centrale, which is now under the auspices of the International Society of Electricians, whose headquarters are in Paris and therefore is not strictly speaking a government institution, but the government has recognized it by aiding it and it has also received various endowments; although the internationl standards of France would not be in its care, as there is another department in the French government where such standards are preserved, it will no doubt be able to obtain duly compared duplicates, and its verification and calibration of other instruments would doubtless not be questioned. Austria is about to establish a government department in which meters and other electrical measuring instruments can be calibrated and officially stamped. The United States, the country in which the electrical industry has developed more rapidly and to a far greater extent than in any other, stands alone in having nothing whatever to compare with the national laboratories of the other leading countries. Our government has its standards of weights and lengths, and it is only a question of time when it must provide itself with standards of electrical measurements. As this time must come why wait until after the need has been felt too much? The international standards have now been fixed, and there is no longer any excuse for not obtaining a number of them, and at the same time providing facilities for having commercial standards compared with them.

Even Lightning is Slow There.

An English contemporary, which is generally careful in its statements, publishes a photograph of a bolt of lightning which it says was taken in the following way: "Mr.—— had a —— camera in his hand during the thunderstorm of July 15th, in broad daylight, and a lightning flash occurred; he quickly pointed the camera at it and snapped the shutter." Our American lightning has more of the American go-ahead qualities about it, and we fear it would have been a waste of a film to have tried that in this country. But perhaps that photographer was an American hustler, or perhaps his camera happened to be pointed in the right direction and it required merely the pressing of the button to catch a slightly belated secondary flash.

Germ-proof Telephone Mouthpiece.

Although the invention is not new, yet it may be of interest to call attention again to the fact that in Germany a mouthpiece is being introduced to avoid the spread of disease carried by the condensed moisture of the breath; the mouthpiece contains a pad made of a large number of disks of paper with a hole in the middle, of which the upper sheet is torn off after each conversation.

An Argument for Rapid Transit.

In the year 1891, the average number of rides on street railways in New York, including the elevated lines, per inhabitant per year, was 267, which is almost double that in Berlin, 140, more than double that in London, 116, and more than four times that in Paris, 84.

Electricity vs. Matches.

A testimony for electric lighting, published in London "Lightning," reads "Invaluable for preventing deterioration of stock. A matchless safety against fire."

ELECTRIC SYSTEM OF THE PHILADELPHIA TRACTION COMPANY

BY HERMANN S. HERING.

II.

THE MAMMOTH WESTINGHOUSE GENERATORS.

The 1,500-hp direct-coupled generators which are being installed as mentioned above, are a comparatively new feature in railway work, and a more detailed account of them will doubtless be interesting.

Fig. 13 is an outline drawing of the 1,500-hp machine, and gives the side view, end view and plan. Fig. 12 is a photograph of one of the generators at the Mt. Vernon power station. An idea of the size of these machines can be obtained from Fig. 14, which shows one of the workmen of the Westinghouse Company standing inside of the field of one of these machines in the Westinghouse shops.

From these views, the general arrangement can readily be seen. The machines are similar in design to those at the World's Fair. They have 10 poles and a circular yoke, 12½ feet outside diameter. A valuable feature is that the field is divided vertically into two parts which can be slid apart on the base plate, giving access to the armature and field coils so that repairs can readily be made without disturbing the engine.

The field is designed according to the usual Westinghouse practice, with cast-iron yoke and wrought-iron, laminated pole pieces. These pole pieces are built of sheet iron punchings, held together with riveted end-plates, and the whole cast into the massive cast-iron yoke, thus securing effective protection against eddy currents in the cores, together with perfect magnetic contact between core and yoke. The machine is compound wound, but a new feature in the winding is that the series coils of the various pole pieces, instead of being connected in parallel, as is customary, are all connected in series, the entire current passing around each, which secures more perfect magnetic balance. These series coils have an enormous cross-section, and are made of strips of Lake Superior drawn copper, forged into spirals, taped and then compressed. One of these coils is shown in Fig. 15. The shunt coils are wound on substantial sheet-iron bobbins and are connected in series with each other as is usual.

The armature also shows some new departures. It has a slotted core built up as a ring, in sections of laminated sheets between two brass end-plates, and securely held together by mica-insulated bolts. The laminated ring is pressed upon the cast-iron hub and securely keyed on. Fig. 16 shows a core of an armature of one of these 1,500-hp generators, finished and ready for the coils to be placed into the slots. Before being wound, this armature is pressed on the engine shaft by means of a hydraulic press. The armature coils are individual and are wound on lathes into a special shape, all together to constitute a continuous parallel drum winding. They are well insulated with mica and have to stand an insulation test of 5,000 volts alternating current, after being placed in the slots. The leading advantage in this method of construction, is that any given coil can readily be removed from the core without disturbing more than a few adjacent coils. No binding wires are used, either on the core or on the projecting ends of the coils. The armatures of the machines of the Philadelphia Traction Company were wound and connected after being mounted in place on the engine shaft, the entire work for a 1,500-hp generator consuming a

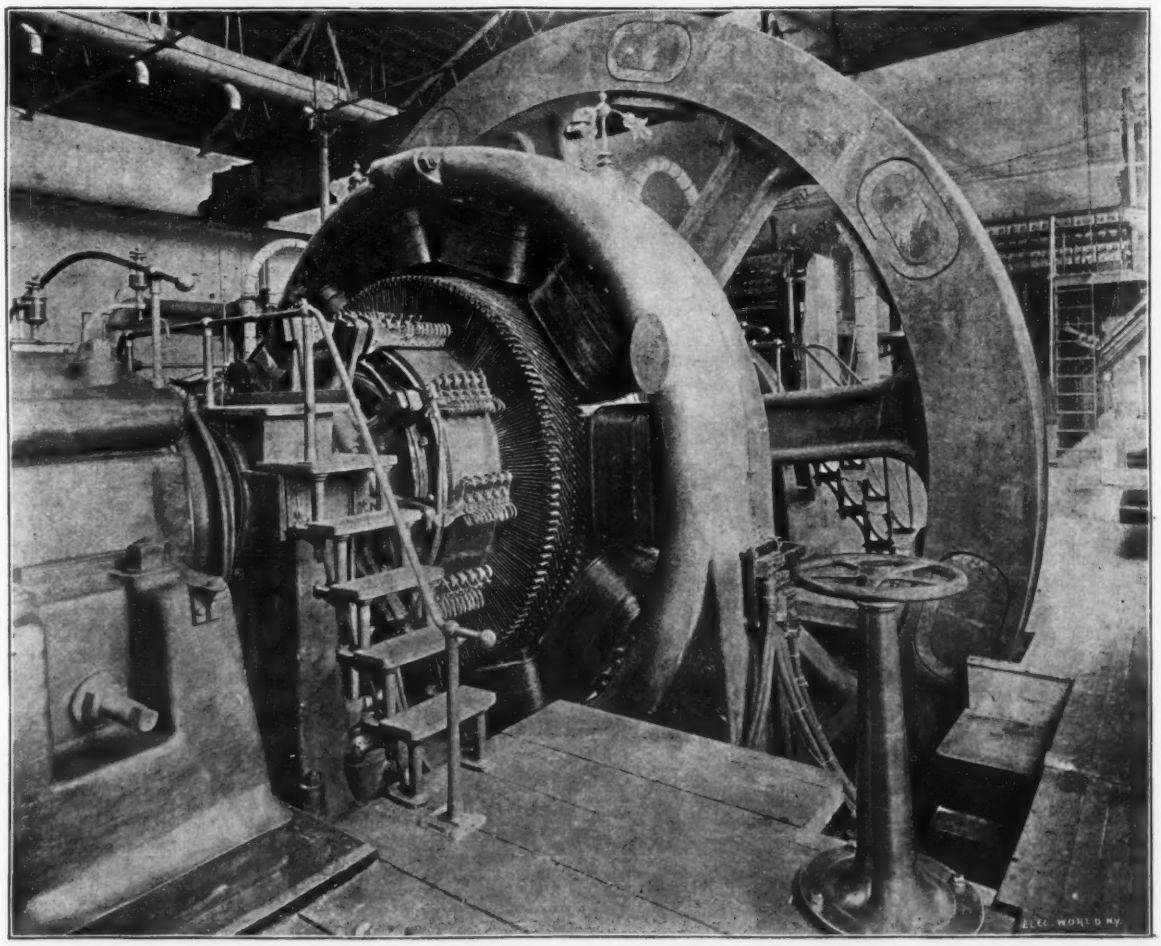


FIG. 12.—1,500-HP GENERATOR, STATION B.

remarkably short space of time; this method has the advantage of doing away with the risk involved in the transportation of a completely wound armature of these dimensions. The diameter of the 1,500-hp armature is 7½ feet, and its width is 22½ inches; the 750-hp armature, as used at the Sutherland avenue station, is 6 feet in diameter and 25 inches wide.

The commutators are entirely built up of drop-forged copper segments, insulated with pure mica. The segments are supported on a ring, making a part of the cast iron armature hub, and are clamped together by taper rings in the usual way, the only, but important, difference being that the outside is made in sections, so as to allow any special strip, or part of the commutator, to be removed, in case of repair, without taking the whole apart. These commutators are subjected to a test of 5,000 volts alternating current before leaving the shops. The diameter of the one for the 1,500-hp machine is 5 feet, and for the 750-hp machine is 4 feet.

The current is collected by carbon brushes, five of which are located in each of the ten brush holder arms. The brushes are individually clamped in a light brass housing, and this is connected to the support by a flexible copper shunt, thereby doing away with all sliding or vibrating contacts inside of the brush holder box. The ten arms are thoroughly insulated and fastened to the iron rocker spider, which can be revolved by means of hand wheels and worm gearing. The rocker spider is held by a stand which is bolted to the engine foundation, and allows the spider to rotate upon a bearing. The arrangement can be plainly seen in the diagram, Fig. 12, and in the photograph, Fig. 13. Formerly the brush holders were supported by arms bolted to the yokes, the bosses of which can be seen in the photograph, Fig. 13. This rendered the brushes difficult of access, while the new plan, allowing of a well insulated stairway to be built over the stand, enables the attendant to readily get at the brushes and also to go from one side of the machine to the other without going around the engines or through the basement. The shifting wheel is of the usual engine pattern, being a 19-inch hand wheel on a 3-foot pedestal placed on the floor, one on each side of the machine, as shown in Figs. 12 and 13.

The weight of the 1,500-hp generator, complete, excluding the shaft, is 130,000 pounds.

The 1,500-hp generator, running at a speed of 80 revolutions per minute, gives 2,250 amperes at 500 volts, while the 750-hp generator gives 1,125 amperes, running at the same speed and voltage. Machines of both sizes are running daily up to the maximum capacity without signs of heating, or any undue sparking at the brushes, and the engineers of the Philadelphia Traction Company say that they have given entire satisfaction so far.

The Westinghouse Electric & Manufacturing Company during the past year received contracts from the Philadelphia Traction Company for 12,750-hp of these generators, divided into six machines of 1,500-hp each, and five of 750-hp.

Mr. R. S. Feicht, the able representative of the Westinghouse Company, in Philadelphia, is superintending the erection of these machines, and the author is indebted to him for the data concerning them.

The Westinghouse Company is also furnishing similar machines, ranging from 300 to 1,500-hp, to power stations in Atlanta, Ga., Indianapolis, Ind., Fairhaven, Conn., Louisville, Ky., Jersey City, N. J., and other places, and this company is to be congratulated upon their success with these machines.

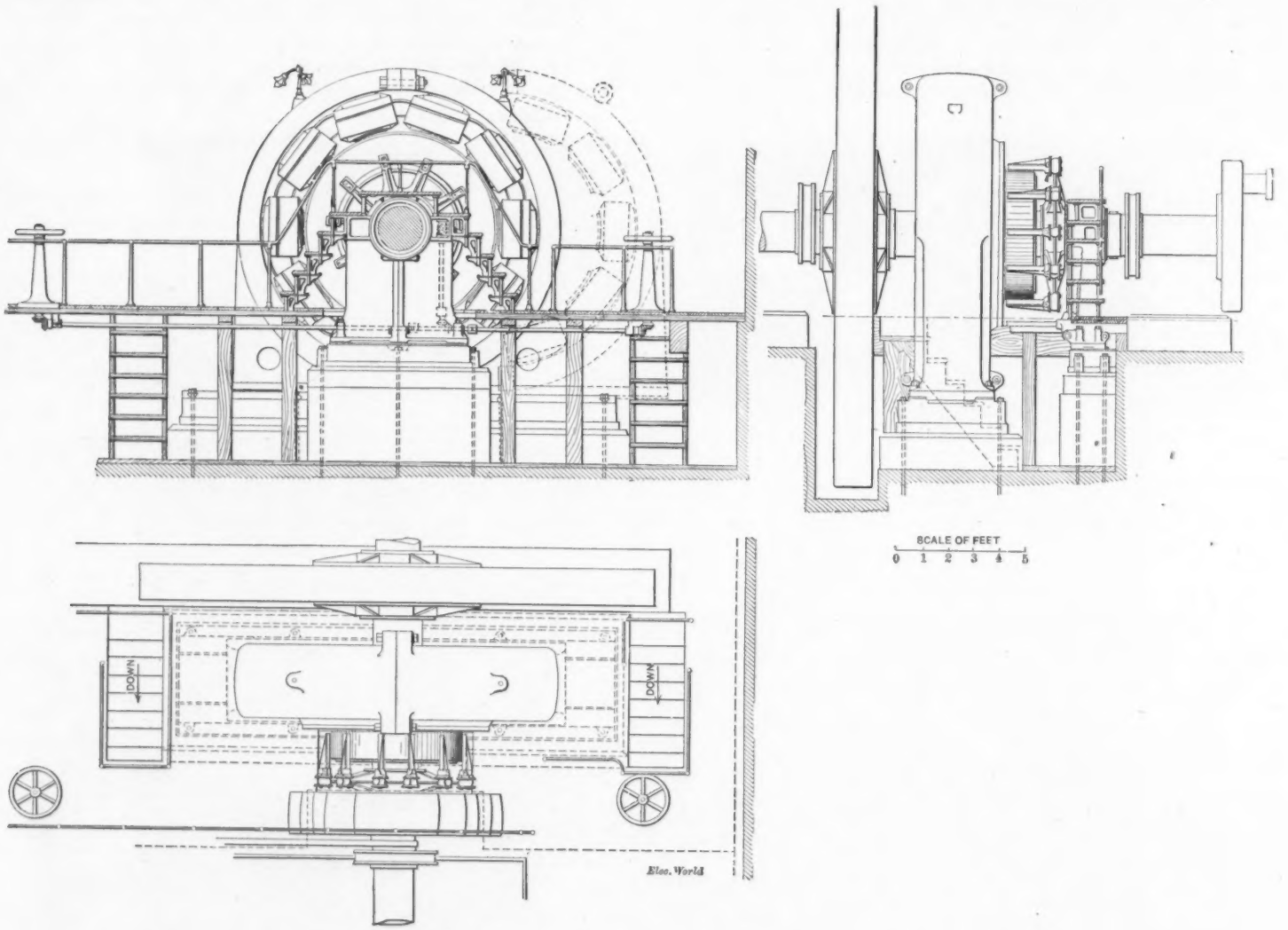


Fig. 13.—Outline of 1,500-hp Railway Generator.

THE TESTING ROOMS.

Each of the four power stations has a testing room equipped with instruments for measuring the insulation resistance of the cables, and with telephones for communicating with the workmen in the subways. The equipment is practically the same in all of them, and consists of a special arrangement of apparatus designed for the purpose, namely, the commercial testing of cables, and planned by Mr. Wm. D. Gharky, the superintendent of underground work. This apparatus is placed on a large pier with stone top, and, in addition there are switches, drops and call-bells for the telephone

circuits. Fig. 17 shows a general view of the testing-room at Station B, 13th and Mt. Vernon streets, with the instruments on the pier in the foreground, and the telephone apparatus to the right in the rear. Fig. 18 shows a plan of the room with all of the apparatus and a diagram of the connections.

Thomson galvanometers were originally used in these rooms, and were shielded by means of two concentric sheet iron cylinders filled

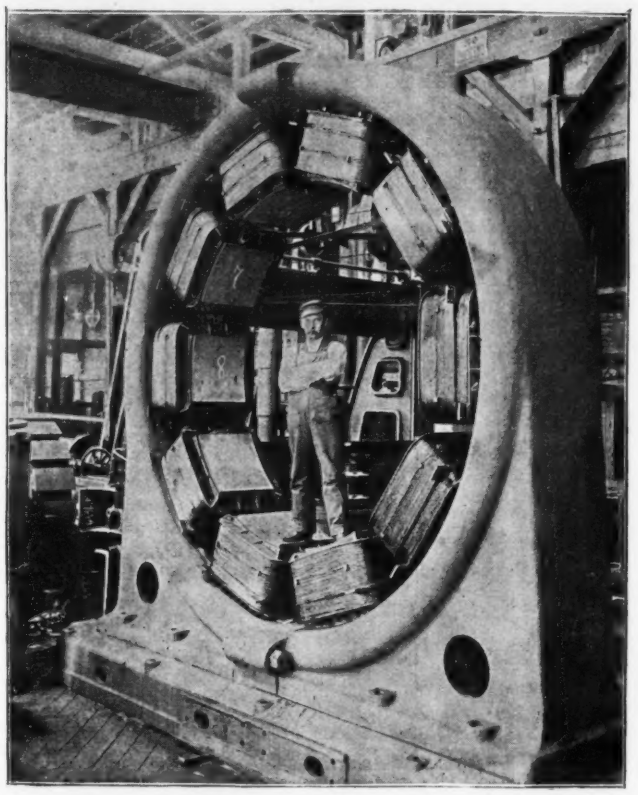


FIG. 14.—FIELD MAGNETS OF 1500-HP GENERATOR.

between with iron turnings; but they were still affected by the feeder currents in the basement and so were discarded, and the new form of D'Arsonval galvanometer made by Queen & Company, substituted with entire satisfaction. Both of these are shown on the pier in Fig. 17. The scale is a transparent one, supported so that it can slide from one side of the pier to the other, and thus be used for either galvanometer or for shifting the zero. A lamp is placed at

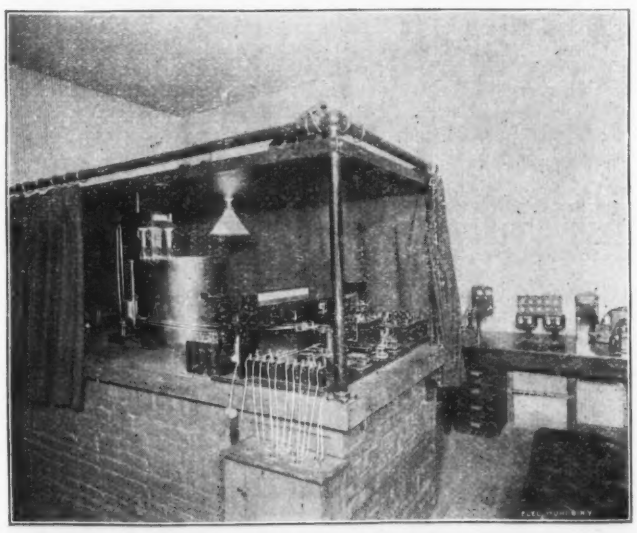


FIG. 17.—TESTING ROOM, STATION B.

each end of the scale, one for each galvanometer, the several lamps used about the table being conveniently controlled by switches. The light spot is a sharp clear line which is easily read. The galvanometer leads are well insulated and run to the shunt box and key and thence to a 100,000 ohm resistance box, from which connections are made with the chloride of silver battery, Wheatstone Bridge, keys, etc., in such a manner that the connections for the various tests—Insulation, Conductor Resistances or Capacity, and can be made simply by shifting the plugs, following in general the scheme suggested by Mr. Carl Hering.* The method of making the test is substantially as described in the same article. In changing from one test to another, it never becomes necessary to change a wire in a binding post; the "wiring," in fact, is permanently made up of brass rod. At the near corner of the pier is a switchboard with terminals connected to well insulated leads, running to the vaults, by means of which the various cables can be connected with the testing apparatus, and also with the telephones to enable the operator to converse with workmen in the vaults and at the manholes. Access to them in the manholes is by means of small junction boxes. Telephone cables run through all the subways; but idle cables are

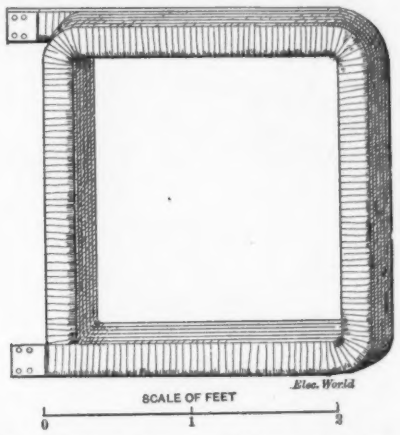


FIG. 15.—SERIES COIL OF 1500-HP GENERATOR.

sometimes used instead. At present there are about 30 miles of telephone cable. The group of lamps over he pier are for the purpose of detecting dead grounds, and also to determine whether a cable is entirely dead, before the operator starts to test it.

The insulation resistance of the cables is determined just after they are laid and also before they are put into use, but not at other times unless some repairs have been made, or there is some special

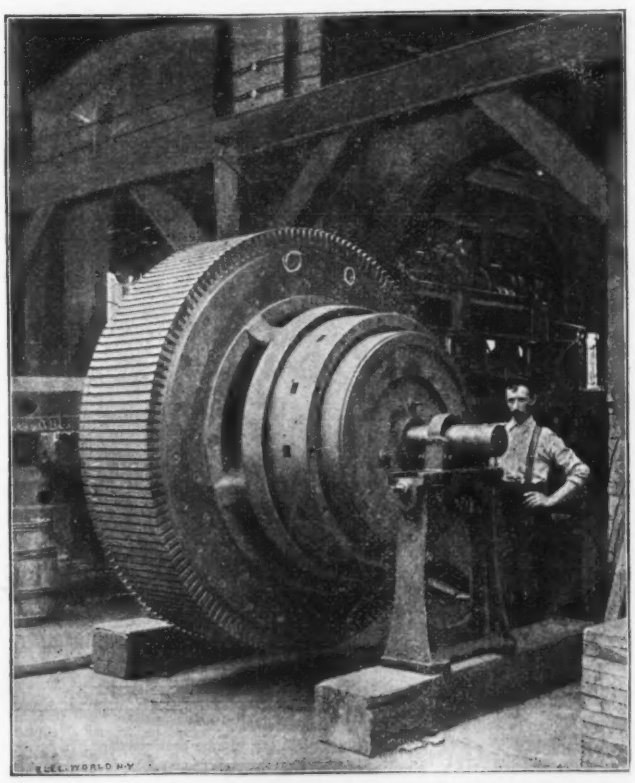


FIG. 16.—ARMATURE CORE OF 1500-HP GENERATOR.

reason for doing so. Very few faults have occurred since the underground system was placed in service, and they were due generally to carelessness on the part of workmen and were easily located; but when faults do occur, the simplest plan is to locate them by disconnecting the cable at the junction boxes in the manholes, one section after another (continuous insulation tests being kept up)

*The Electrical World, March 7, 1891, p. 188.

until the fault is found, and then replacing the defective section between the manholes, which is a distance of from 200 to 400 feet. Attempting to locate such faults electrically in 200,000 to 1,000,000 circular mile conductor, even in cases of a dead ground, would be uncertain on account of junction resistances, earth currents, etc., and involve more trouble and expense than the "cut and try" method. It is of course hardly necessary to remark that the work done in a testing station of this kind is carried out on a business basis, with the same practical routine and discipline as the operation of a Power Station. Reports of the various values of a cable which are practically correct, and this in the shortest time possible, are the result sought, rather than the exactness of the Laboratory. The arrangement of the apparatus is such as to secure the greatest convenience to the operator, and thus facilitate the work.

The instrument for all the testing rooms at these stations was furnished by Queen & Company, Inc., of Philadelphia.

POWER DISTRIBUTION.

The general system, adopted by this company, of distributing the power, is to feed insulated sections of the trolley by means of independent feeders from the power stations, this method being necessary on account of the possibility of accident to the underground feeders, and because any feeder must be capable of being cut out without interfering with the operation of the road. Feeders run from the switch board of the power station to the vault in the basement, where there is a junction box. From this junction box the lead armoured cables run into the conduits and to the section of the line which they supply, which section is usually a length of from 1,000 to 4,000 feet. This portion of the trolley is connected to the feeder cable from 3 to 5 times and is insulated from the adjoining section of trolley by a section insulator. Each section, therefore, is independent, and if any trouble occurs in the cable or underground connections, the section can be disconnected from the cable and connected to the adjoining sections temporarily, which renders a stoppage from cable breakdowns a difficulty quite easily remedied and with but little delay. The return circuit is through a complete system of return feeders, which are carried in the conduits and are connected to the rails at every manhole. These return feeders run to the switchboard at the power station and convey practically all of the current, very little returning through the earth.

(To be continued).

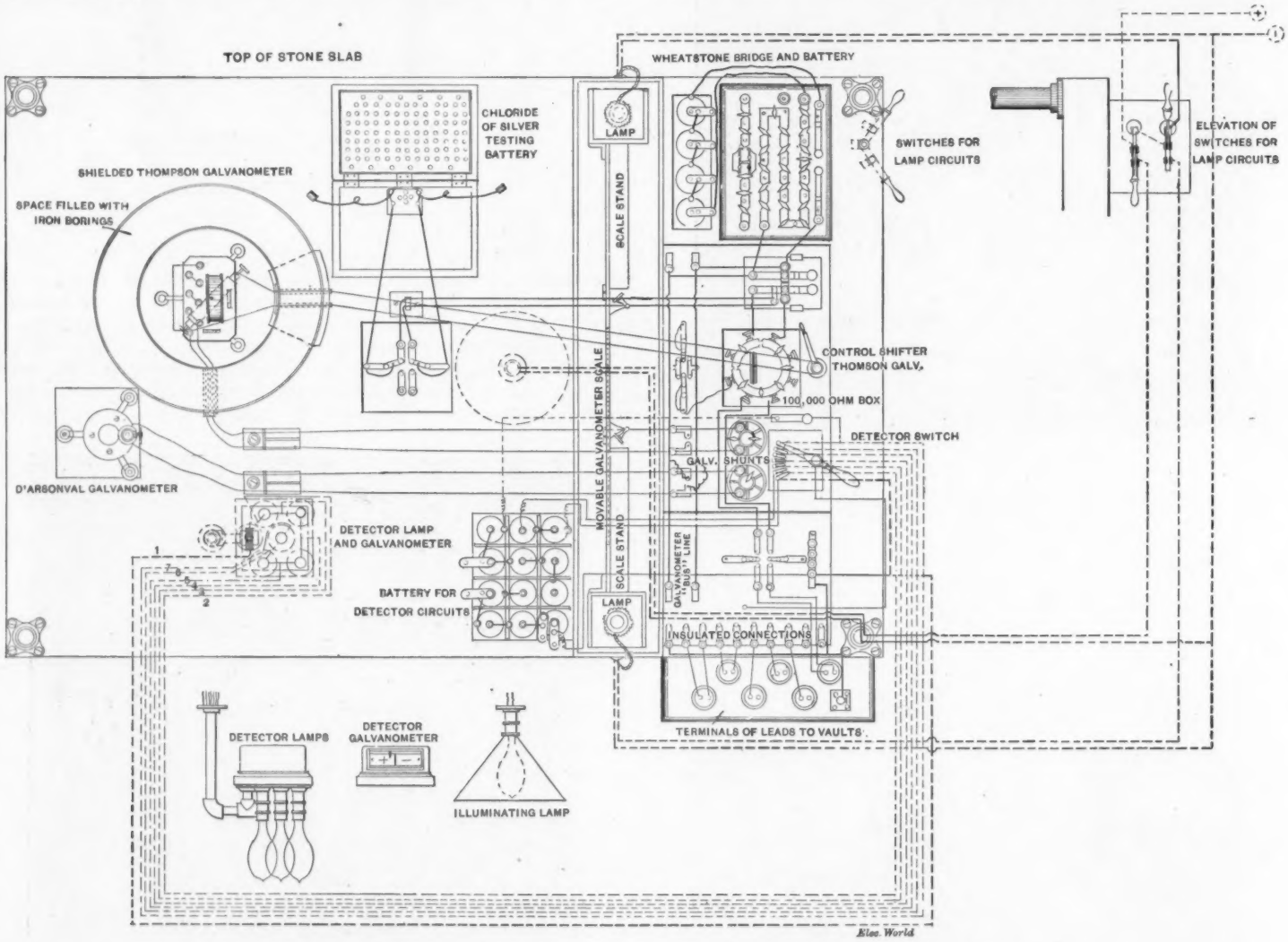


FIG. 18.—ARRANGEMENT OF INSTRUMENTS, MT. VERNON STATION TEST ROOM.

Electric Traction in France.

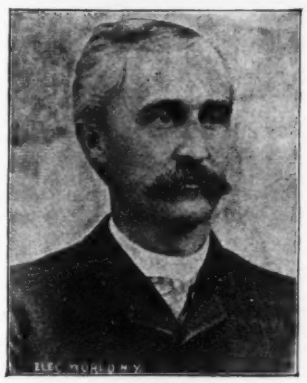
Electric traction is still in Europe such a novelty that the "inauguration" of a complete urban system is marked by a ceremony which is frequently pleasant and at times positively overwhelming. In February, 1874, the town of Havre was the first to adopt horse tramways, and on the 25th ult. it formally became the first town in France to apply electricity entirely to the same network. The tramway company and the electrical contractors (The French Thomson-Houston Co.) celebrated the occasion by issuing 400 invitations, taking down their guests from Paris by a special train, feasting them at Havre with "sumptuous" breakfast, luncheon and dinner, carrying them about in a triumphant procession in ten trolley cars up and down the town, and finally starting them all back to Paris on the following morning at sunrise. It is to be hoped that as electric traction becomes less novel, the inaugural ceremony will become less trying. An item of considerable novelty in connection with this line is the fact that the current is supplied by the local electric light company, although not from the lighting dynamos, since the company's system is alternating. The traction plant consists of three 4-pole, 200-kilowatt, 500-volt Thomson-Houston dynamos rope driven by Farcot-Corliss condensing engines. The rolling stock consists of 40 cars, 24 of which are driven by a single 25-hp single reduction motor, the balance having each two such motors. The network of the tramway company is equal to 40 miles of single track.

Electric Cooking.

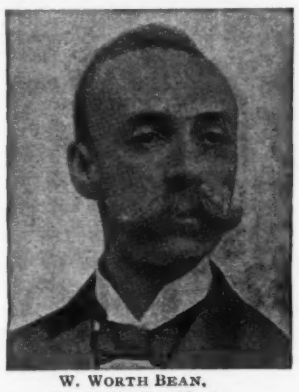
Queen Victoria of England uses electricity for cooking at her residence at Osborne, Isle of Wight, for "the more delicate dishes only."

Notwithstanding that it was the thirteenth annual meeting, the convention of the American Street Railway Association at Atlanta last week was one of the most successful—in many respeects the most successful—ever held by the association.

Never before have the transportation arrangements been so perfect, not only for reaching the convention city but also for the home journey. The hotel accommodations, particularly at the Aragon, were excellent; the weather throughout the entire week was simply delightful; the citizens of Atlanta did everything possible to render the visit of the delegates one long to be remembered, while the papers read were numerous and important and the exhibits so complete and interesting as to be well worth making a long journey to enjoy.



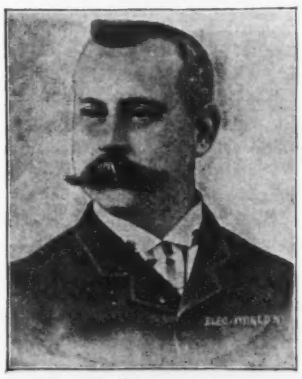
JOEL HURT,
President.



W. WORTH BEAN,
First Vice-President.

The opinion was freely expressed in Atlanta that the Gate City had never entertained a more representative body of men; and that no convention ever held in that city had been more generous in its expenditures. On behalf of the visiting street railway men it may be added that the cordial southern welcome extended to the delegates will insure for Atlanta and the New South a warmer place than ever in the hearts of those who attended.

The next meeting of the association, as will be seen farther on in the report, is to be held in Montreal. Those who attended the convention of the National Electric Light Association in that charmingly hospitable city will not need to be told how promising a prospect the representatives of the street railway interests of America have, therefore, before them for an enjoyable convention in 1895.



JOHN H. CUNNINGHAM,
Second Vice-Presideut.

RUSSELL B. HARRISON,
Third Vice-President.

At Atlanta the exhibtion and the meetings were held in Machinery Hall at Piedmont Park, where the forthcoming Interstate Cotton Exposition is to be held, and which is about two miles from the centre of the city. Books of special tickets, good on any of the Atlanta street car lines, enabled the visitors to travel free between the place of meeting and the hotels and the service to the ground was so prompt and efficient that the journey did not count.

The first session took place on Wednesday morning, the attendance being quite large and the interest in the proceedings unmistakable.

President Henry C. Payne, of Milwaukee, called the meeting to order and introduced Hon. W. J. Northen, governor of the State, who extended a most cordial welcome to the Convention. He called attention to the delightful climate of Georgia and its great resources, and expressed the hope that visitors would not only return to visit the Exposition but would bring their industries and settle in the State. The South, the Governor said, had felt the financial stress far less than the North. The records also show that the people of the South owe less money than those of any other section. He suggested that the cheaper raw materiai and better manufacturing advantages of Georgia ought to prove a strong inducement for the investment of capital. Already the South had 1,611 miles of street railways, with an invested capital of $71,000,000. The Governor thought the street railway the greatest factor of civilization known to the modern world.

President Payne, on behalf of the association, fittingly acknowledged Gov. Northen's welcome.

Letters of regret at their inability to be present were read from past presidents Chas. B. Holmes and Henry M. Watson.

President Payne then delivered his address. The depression which had prevailed in all parts of the country, he said, had not been without its compensations, as it had limited the constitution of unproductive lines and enforced economy. During the transition from animal to electric power the association had devoted its attention largely to the application of electricity to transportation purposes, but now the practical operation of the roads should be considered. President Payne thought the management of a street railway equipped for rapid transit more vexatious than that of a steam road and requiring quite as much ability. The wonderful development of the electric railway had led to excessive valuations of franchises which has resulted in excessive taxation. The President also called attention to the various topics before the convention for discussion, and closed with a brief tribute to the memory of Wm. Richardson and W. J. Stephenson.

The report of the Executive Committee, which was then presented, in commenting on the business depression, said: "Business in general during the last year has been bad, and the street railway business in particular has suffered, several of our member-companies having gone into the hands of receivers, while consolidation still continues to be tne trend of the times. While the year has been a hard one, the business outlook is encouraging, and we look forward with confidence to a successful year's business."

The report enumerated a number of changes which had taken place in the membership, the present number being 184 companies, exclusive of additions at the Atlanta meeting. Reference was made to the special reports to be presented as covering a wide range of subjects, and the commitee touched upon the subject of the exhibition of street-railway supplies, which was fast becoming a prominent feature. A list of judicial decisions published during the year was given, and it was stated that the second volume of "American

Street Railway Decisions'' would be issued during November. Two amendments were submitted, one to the Constitution and one to the By-Laws. The proposed amendment to the Constitution is to provide for the admission of individuals and companies, not street railways, as associate members, under certain conditions; such character of membership having been found conducive to the general welfare of kindred associations. The proposed amendment to the By-Laws has in view morning sessions only; providing for less exhaustive meetings; for more opportunity for social enjoyment, as well as for opportunity to examine the display at the Exposition, which has become so important a feature of the annual meetings. The adoption of the foregoing amendments would mean that there will be in the future two classes of membership—associate and active; and that the meetings will open on Tuesday and continue for four days.

The report of the treasurer showed that the receipts for the year had been $8,290.79, and the expense $8,196.72, leaving a balance of $94.07.

A communication from the Georgia Electric Light Company was read, extending an invitation to the delegates to visit its plant.

The first committee report presented was on ''The Best Method of Treating Accidents and Complaints,'' and was read by Mr. P. M. Dyer, claim agent of the West Chicago Street Railroad Company. This paper will be found in another column.

In the discussion which followed, Mr. Dunlop, of Washington, stated that the paper embodied his views on the subject. President Payne said that his company pursued the same course, and that as they had little chance before a jury, settled a case as soon as possible. In reply to inquiries from Messrs. Little, of New Orleans, and Shaw, of Newburyport, Mr. Dyer said that the statements they obtained from their employees sometimes, but not always, were sworn to before a notary public; that the motorman who was found responsible for an accident was sometimes assessed and sometimes discharged, depending upon the frequency of the accidents and his record. In a case cited, where a motorman turned his head away and ran over a person, he stated that they would discharge such a man as soon as a statement was obtained, regardless of the cause which led him to look away. Mr. Fuller of Chicago, stated that it was the rule of the West Chicago Railway Company that one car approaching another must slow down or stop before reaching it, and a motorman was discharged for the violation of this rule. In regard to temporary relief, Mr. Dyer said that his company provided it to the extent of transportation to home or hospital and the payment of the physician called to the drug store or other place where the injured person had been temporarily carried. Mr. Shaw cited two cases where men had been injured in his power-house where the company was not responsible and claims had been brought against them. Mr. Dyer stated that in such a case the first thing would be to ascertain the law, and that even where the company was not legally responsible the question of charity would come up, in which case a release should be exacted. He said his company had been insured from 1890 to 1891, but since then had taken its own risks. Mr. Payne stated that the trouble with insurance companies is that they do not insure more than half the accidents. Mr. Connette, of Nashville, stated that his company pursued about the same method as that outlined in the paper. After the accident occurred they investigated it immediately and if they found the company liable then they took the best care of the injured party possible; if they found the company was not liable then they ceased expense altogether. They found that if they could not settle a case the best way was to keep the matter in court as long as possible, as it was then more easily compromised; they also found it wise to use their influence to get such men on the jury as would give a corporation justice. Mr. Cole, of Elmira, said that in case of accidents they generally promised the motorman that if he could obtain evidence sufficient to exonerate him from all blame he would be reinstated in his position, and that in a good many cases the motorman had been able to do this. In case he did not succeed he was suspended and given other work until the case was settled and he was then generally discharged.

The next business was the report on ''A Uniform System of Street Railway Accounts'' by Mr. H. I. Bettis, reprinted in abstract elsewhere. In the discussion Mr. McNamara, of Albany, said that in Albany they are required to distinguish between roadways and track, and renewals of ties, rails and paving ties, rails, spikes, joint plates, paving, sand, stone, labor ought to come under one head, and this is what is required by the Railroad Commissioners of New York. They do not object to dividing as much as desired in the books, but in the report submitted by them, they must all come under one head.

Mr. Dyer of Augusta said he did not suppose it would be possible to get a form to fit every case, and that a small road, if the proposed plan were entirely carried out, would find it expensive, because they would be compelled to have a storekeeper who would charge up the different things used each day. He thought it the custom with small roads to charge up their bills each month as they come in, as if they had been used. It is not correct, but the expenditure for the man to take charge of the store-room and keep accounts of the material used, would be in some cases almost as much as the cost of the material.

Mr. McNamara added that he has not a large road, but has a storekeeper who charges the several accounts with the material as it is used. There is no other way to determine what is used in any particular month in the year, as the writer of the paper suggests. The storekeepers are not paid such a large amount, and it is found that they do good work and that it pays.

After several announcements the convention adjourned.

An executive session was held on Thursday morning, by order of the Executive Committee. The subject of ''Transfers and Commutations,'' was first considered, the general impression being that the privileges should not be extended further than is absolutely necessary. The subject of the formation of a street railway mutual fire insurance company was also taken up, and on motion of Mr. Russell B. Harrison the incoming officers and executive committee were appointed a committee to report on the subject. On motion of Mr. Littell of New Orleans, Messrs. Littell, Perrine and Connette were appointed a committee to wait upon the officers of the Underwriters' Association of the South, with a view to securing better conditions and rates for insurance of street railway properties, the office of the Association being in Atlanta. The executive session was then adjourned.

Mr. Strathearn Hendrie then presented his report on ''Can the T-Rail Be Satisfactorily Used in Paved Streets?'' an abstract of which is printed elsewhere in this issue.

On motion of Mr. McLean, the following gentlemen were appointed a committee to nominate officers and select a place for the next meeting: Messrs. McLean, Connette, McNamara, Baumhoff, Breeg, Semmes and Rugg. Letters of invitation inviting the Association to hold its meeting in their respective cities were presented in behalf of Cincinnati, O., Philadelphia, Pa.; and the invitation extended at the Milwaukee meeting by Mr. Lusher, of Montreal, for the Association to hold its meeting in that city for 1895 was read by the secretary.

The meeting was called to order at 10.30 A. M. the first business being the report of the committee on ''City and Suburban Electric Railways'' by Mr. E. C. Foster, an abstract of which will be found in another column.

Mr. Russell B. Harrison then read a report on the ''The T-Rail Construction of the Terre Haute Electric Railway'' which will be found abstracted elsewhere in this issue.

Mr. Harrison, in reply to inquiries from Mr. Seeley, said that he could not give any comparison between the cost of the T-rail construction as compared with girder rail construction of the same weight, as they had not laid any girder rails of the same dimensions as the T-rails. He said that his company had had no experience with granite blocks, but he was confident that the rail could be laid as successfully with such a paving as with brick or asphalt. Concrete foundations gave a perfectly smooth traffic. They spared no expense to make the joints as solid and rigid as possible. As to expansion

and contraction so much of the metal was below the surface that very little trouble was suffered from this cause. The joints are Wheeler joints and rest on the tie and the rail is stamped up with concrete, so that not only the ties but the rails rest on solid concrete. The result is that there are practically no joints in the rails.

Telegrams were read from Thomas Lowry, president of the Twin City Railway Company, Minneapolis, and from the Commercial Clubs of Minneapolis and St. Paul, inviting the association to hold its next meeting in the great convention city of the Northwest —Minneapolis.

A letter from O. T. Crosby was read regretting his inability, owing to pressure of business, to present a report on "Standards for Electric Street Railways." On motion of Mr. Perrine, the Committee on Standards was continued.

M. K. Bowen, of Chicago, recommended that a committee be appointed to investigate the subject of the validity of patented articles used by street railways, and Mr. Perrine moved that a committee be appointed on this subject. The motion was carried.

The matter of the proposed amendments to the Constitution and By-Laws was then considered. An informal vote was taken as to the adoption of the amendments, and it was the unanimous judgment of the members that the amendments should be adopted. Final action on the same will be taken at the next annual meeting.

The special committee appointed to interview the representatives of the Underwriters' Association of the South reported that they had been unsuccessful in their efforts.

Captain Brophy, of Boston, representing the Mutual Insurance Association of New England, thought it would be better for each State association of railways to make application to the board of underwriters of the mutual companies which control its territory, and that something might be done in this way to secure a reduction. His company had been insuring electric light stations for two years and car-houses for one year, and had at present $7,000,000 of property of this class. For the 10 or 12 months ending in October their loss had been $2,300 on the $7,000,000, so that the electrical business is not as hazardous as some people think. Their rate for electric light stations is one per cent., which calls for a model station. They do not insist upon cement or iron floors, nor that the roof shall be 18 feet high, but they ask that the plant be clean and that there be no oil on the floors, no finish on the walls and no attics or basements. If there is a basement or second floor used for storage, it must be equipped with automatic sprinklers Their experience with car-houses had been, so far, very fair, but they could not yet tell how much the losses would be. Their expense for inspectors amounted to 6 per cent. of the premiums received and the total expense, including losses, to 12 per cent. They had no special district, although the majority of their business was in New England. Of the $7,000,000 about $500,000 was on railway property. Their rate on brick power-houses is one per cent., on frame power-houses one and one-quarter per cent.; on car-houses and contents (including cars), brick, one and one-quarter per cent.; frame one and one-half per cent. They were limited to $60,000 on one building and contents, and therefore could not insure the larger street railway companies.

Mr. Harrison agreed with the suggestion that it would be of great interest and profit to the association if a committee were appointed, and moved that a committee of five be chosen to take up the matter with the New England companies.

Mr. Seeley stated that the Standard Oil Company carried its own insurance with a profit, and thought there was no reason why the street railway business could not do likewise and establish a mutual company of its own with a central office.

The motion to appoint a committee was carried and the following gentlemen were appointed by the president: Messrs. Harrison, Terre Haute; Dyer, Augusta; Perrine, Trenton; Lusher, Montreal; Baumhoff, St. Louis.

Mr. Perrine offered a resolution to the effect that the Executive Committee take under consideration the question of the enlargement of the field and scope of the association, and submit a plan suggesting ways and means therefor, at the next meeting of the Association.

The Nominating Committee then presented the following report: President, Joel Hurt, Atlanta, Ga.; first vice-president, W. Worth Bean, St. Joseph, Mich.; second vice-president, John M. Cunningham, Boston, Mass.; third vice-president, Russell B. Harrison, Terre Haute, Ind.; secretary and treasurer, William J. Richardson, Brooklyn, N. Y.; executive committee, Henry G. Payne, Milwaukee, Wis.; W. H. Jackson, Nashville, Tenn.; D. G. Hamilton, St. Louis, Mo.; G. C. Cunningham, Montreal, Canada; J. N. Partridge, Brooklyn, N. Y. These officers were duly elected.

The committee recommended Montreal, Can., for the next meeting. A motion was made to adopt the report, except as to Montreal for the place of next meeting. This motion was annulled by a motion to adopt the report of the committee as a whole, which was passed by a vote of 37 to 19.

Mr. Penington moved that Philadelphia be substituted for Montreal as the place of meeting. A spirited discussion ensued on the question and amid the calling of the roll much interest was manifested as to the result. The vote when taken stood as follows: Montreal, 38; Philadelphia, 17.

Mr. Cunningham, of Montreal, arose to express his pleasure that that city had been decided upon as the next place of meeting of the Association, and assured the members that there would be no difficulty in bringing supplies to Montreal, and that there would be no hindrance to the exhibition, which had now become so important a feature of the annual meeting.

The report of the committee on "Mail, Express and Freight Service on Street Railway Cars," by Mr. R. McColluch, was read by title only; an abstract of this paper is given elsewhere

The report of the committee on "Transfers on Street Railways," by J. N. Beckley, was then read by title; an abstract is given on another page.

The report of the committee on "The Use of the Booster on Electric Railway Circuits," by J. H. Vail and S. H. Wyncoop, was next presented and an abstract of this paper will be found in another column.

Messrs. Dunlop, of Washington, and McNamara, of Albany, were appointed a committee to escort the newly elected president to the chair. Mr. Payne introduced Mr. Hurt, who, in a few happy remarks, expressed his appreciation of the honor conferred upon him and assured the association that he would do everything in his power to advance its interests. On motion of Mr. Perrine a vote of thanks was passed to the retiring officers; the Atlanta Consolidated Street Railway Company; the Capital City Club; the Local Press, and the citizens generally of the City of Atlanta, for the courtesies, kindness and attention, and generous hospitality, which had been extended to the association.

A paper on "Destructive Arcing of Five Hundred Volt Fuses," by W. E. Harrington, was read by title only, and will be given in abstract in next week's issue.

A paper on "Brake Shoes," by D. F. Henry and Powell Evans, was read by title only, and appears in abstract elsewhere.

Mr. Davis moved that a committee be appointed, to consist of two members of the association, and one manufacturer, to investigate the subject of the adoption of a standard style of brake shoes, conduct experiments, and to report the data collected, and its conclusions, at the next meeting, without expense to the association. The motion was carried.

The report on "Power Brakes vs. Hand Brakes," by E. J. Wessels, was read by title. An abstract of this paper will appear in our next issue.

Mr. E. A. Sperry replied to a number of criticisms by Mr. Wessels on his American Institute paper, denying the superiority of the air brake and pointing out the many advantages of the electric brake.

The special paper by Allen R. Foote, on "Taxation," a brief abstract of which is given elsewhere, was read by title.

The Convention then adjourned.

The Social Features of the Convention.

The association met with a most cordial reception at the Gate City. From the moment of their arrival until the time of departure the members were showered with attentions.

On Wednesday evening, October 17, the Capital City Club threw open its doors to the visitors. Major Livingston Mims, president of the club, made a felicitous speech of welcome and the hours sped merrily with music, dancing and feasting.

The banquet given at the Kimball House on Thursday evening will be long remembered by those who remained for the speeches. All agreed that the decorations, music and menu were unsurpassed, but when President Payne uncorked the flask of Southern oratory it sparkled with greater brilliance than all the red wine, golden champagne and verdant creme de menthe.

Until after two o'clock in the morning the speeches continued.

Mr. Stedman was the first to be called upon. He explained in lively verse the origin of toasts and the function of toast-masters. New Yorkers especially appreciated the lines:

> "Until at last old Jove himself an orator Depewted
> Who was in every detail to this special office suited."

The "City of Atlanta," was responded to by Judge H. E. W. Palmer, who until recently was the manager of the General Electric Company in that section. The "New South," by Hon. L. C. Levy and "Our Country," by Hon. Fleming DuBignon, were all masterpieces, while "The Local Press," by that brilliant young journalist, Mr. Lucian L. Knight, was fairly drowned in applause. All the addresses rang with genuine fraternal feeling and North, South, East and West were welded into one sympathetic whole by the strong current of friendliness present.

The barbecue was the feature of Friday afternoon. This took place at Ponce de Leon Park, and for local color outranked all other entertainments. It was largely attended and the viands and beer vanished with modern street railway rapidity. The recollection of the long breast-high tables and wooden plates, the glowing trench, with its sizzling freight, the skilful carver armed with a cleaver, barrels half concealed by ice, and above all and everywhere the ubiquitous darkey, will linger long in the minds of the appreciative delegates.

The press of Atlanta, notably the famous morning "Constitution" and the evening "Journal," devoted great care and attention to publishing daily reports of the proceedings—a feature which pleased every one and won for these papers many new friends.

Other cities have been as demonstrative as Atlanta; other localities have risen to entertain the Street Railway Association and its attendant army of supply and newspaper men, but the Gate City threw its portals open with a grace and hospitality so courteous and unrestrained that it will ever occupy a unique position in the affection of the visitors last week it entertained so royally.

The Journey to and from Atlanta.

"Rat, tat, too, Royal Blue;
Shenandoah, Shenandoah brought us through"

is what a large and happy contingent of the association will remember of the trip from New York to Atlanta. Under the friendly care of Mr. L. J. Ellis, of the Norfolk & Western Railroad, nearly a hundred delegates and ladies were conducted in safety and comfort to the Gate City and back to Gotham. All joined in praising meals, accommodations, service; and only one unhappy man, Mr. John Ashby Seely, had cause for complaint—the climate. Whether Mr. Seely was equipped with too heavy gear or whether Heaven intends him for a cool clime we know not, but at all events it was hot enough for him.

The trip south was enjoyable but the return journey so far exceeded it in pleasure that words almost fail to describe it. Even stout-hearted Major Evans was observed to drop a tear as Jersey City loomed upon his vision.

At Chattanooga, on the way back, the delegates were allowed time to visit Lookout Mountain, Missionary Ridge and interesting points about the city. The magnificent views to be had from Lookout Mountain and the Ridge impressed even the most critical visitor with their grandeur, while the battles that formerly troubled these sunny valleys seemed like desecration. The Soldiers' cemetery, with its thousands of tiny headstones, many of them bearing no word, but a single number, stirred the living to reverential respect for the brave boys who lost names as well as lives in the war.

On Sunday morning a "sermon in stone" was enjoyed at the Natural Bridge of Virginia. A pleasant drive among the gorgeously tinted hills led to this famous freak of nature, which is a marvel, even when overrun with hilarious members of a convention. Later in the day the Caverns of Luray were visited, and there even the most flippant were hushed by the wonders of that fairy land beneath the earth. Much surprise was evinced that no energetic delegate had as yet arranged to lay tracks through those winding corridors. They contented themselves with discovering and dodging a live wire so far beneath the sod.

At Luray the passengers on the Shenandoah route passed the subjoined resolution, to be followed this week by a more substantial testimonial to Mr. Ellis from those who journeyed under his charge.

Whereas, a large number of those attending the Atlanta Convention of the American Street Railway Association have traveled to and from that city over the Shenandoah route; and

Whereas, The unqualified pleasure and the brilliant success of the railway trip have been due to the unwearied efforts and thoughtful supervision of Mr. Leroy J. Ellis, Eastern Passenger Agent of the Norfolk & Western Railway; be it therefore

Resolved, That the hearty thanks of the passengers by the special train personally conducted by Mr. Ellis, be and are hereby extended to that gentleman for his unremitting attention to their comfort and his prompt aquiesence in any suggestion that could be met.

Resolved, Further, that Mr. Ellis be and is hereby congratulated upon the striking punctuality in the adherence to the train schedule, as evidencing the high standard of railroad efficiency in the New South; and

Resolved, That a copy of these resolutions be engrossed and presented by a committee to Mr. Ellis, together with a souvenir that may serve to remind him of the occasion as well as of the high esteem in which the street railway men and street railway supply men hold a typical steam railroad man.

Other northern and eastern delegates enjoyed the comforts of the Southern Railway in another and even longer special train. This party on the return trip stopped off at Asheville and visited the Vanderbilt estate. That the members of it appreciated the favors and courtesies extended them is shown by the following resolutions passed at Hickory, N. C., on October 21st:

Whereas, The ladies and gentlemen composing the special train from New York to the convention of the American Street Railway Association at Atlanta, October 17 to 19, travelling over the Pennsylvania Railroad and the Southern Railway, have enjoyed unusual privileges and advantages over the system of the Southern Railway, whereby they have been enabled to visit the historic grounds of Lookout Mountain and Missionary Ridge, at Chattanooga, Tenn., and view some of the grandest scenery of the world in the Blue Ridge Mountains around Asheville, N. C., and have received unsurpassed accommodations at every point; therefore be it

Resolved, That the cordial thanks of this entire party be heartily extended to the above corporation for their courtesy and kindness throughout.

Resolved, That special thanks are due to W. A. Turk, of Washington, D. C., general passenger agent of the Southern Railway; to S. H. Hardwick, Atlanta, assistant general passenger agent, and to A. S. Thweatt, of the New York, Eastern passenger agent, for the general plan and arrangement of our itinerary.

Resolved, That we particularly desire to thank Mr. Geo. C. Daniels, New England traveling passenger agent of the Southern Railway, who accompanied us on our entire trip, for his courteous, tireless and unceasing attention, and we do most sincerely congratulate the Southern Railway Company on having such an efficient and obliging agent in their service.

Those of the party who attended the convention of the National Electric Lighting Association in Montreal, and remember the hospitality and courtesy extended to guests on that occasion, anticipate much pleasure in visiting that city next year as members of the Street Railway Association. May the meeting be as successful and agreeable as that at Atlanta is all that one need wish.

What Helped Make the Convention Memorable.

MR. ARTHUR S. PARTRIDGE, of St. Louis, had a useful little advertisement in the form of triangular lead pencils.

A NOVEL ROLL-BLOTTER was given out by the Sterling Company, of New York, as a reminder of the convention.

"JIM" GODFREY, of the New York Insulated Wire Company, put in an appearance early, and was as much sought after as ever.

THE R. D. NUTTALL COMPANY, of Allegheny, Pa., had a comprehensive and artistic exhibit of their well-known specialties.

F. A. MAGEE carried the banner for the universally known house of The E. S. Greeley & Co., of 5 and 7 Dey street, New York.

WILLIAM S. SILVER & CO., of 26 Cortlandt street, New York, presented visitors with glass pens which met with popular approval.

CARLTON & KISSAM, the street car advertising firm, distributed among the delegates an artistic and useful gift—a pocket knife.

MUNSON BELTING was well displayed. Much of the business done by this company comes from electric railway and electric light companies.

THE ST. LOUIS CAR COMPANY gave away "Snap Shots of the World's Fair," a collection of some of the best views taken at the Chicago Exhibition.

THE STERLING SUPPLY & MANUFACTURING COMPANY had a very effective exhibit of their many specialties and gave away a unique souvenir.

THE "TRENTON TROLLEY WAGON" was kept in practically continuous operation to show its many excellent points. This wagon is certain to have a large sale.

MR. JOHN W. OSTROM, of the Pennsylvania Steel Company, Philadelphia, pleased the gentlemen with some very choice cigars, each enclosed in a glass tube.

LEWIS & FOWLER, a name so long among the leading street car manufacturers, displayed the "Acme" Car Jack that received more than ordinary attention.

MR. W. P. SEGUINE, manager of the Railway Department of the Frost Veneer Seating Company, of New York, presented very pretty celluloid calenders at the convention.

THE INTERNATIONAL REGISTER COMPANY, of Chicago, had one of the most effective fare register displays, and Secretary A. E. England received many compliments.

THE CREAGHEAD ENGINEERING COMPANY, of Cincinnati, O., displayed a line of overhead material that attracted considerable attention. G. R. Scrugham was in charge.

SMITH OF NEW YORK, whose exhibit adjoined that of

FULTON FOUNDRY EXHIBIT.

Benedict & Burnham, made a very good display of headlights and electric lighting clusters for street cars.

THE JOHN STEPHENSON COMPANY, through Messrs. J. A. Tackaberry and D. W. Pugh, distributed a number of pretty patent tape measures, which were much appreciated.

THE MEAKER REGISTER, manufactured by the Maeker Mfg. Co., of Chicago, had President Maeker as its sponsor, and as was to be expected, he did the thing up in proper style.

H. W. JOHNS MANUFACTURING COMPANY made a comprehensive display of their insulating material. W. F. D. Crane, Henry G. Issertel and W. H. Gould were in constant attendance.

MR. JAMES F. M'LAUGHLIN and Mr. George Lord of Philadelphia exhibited a conduit system, the invention of Mr. McLaughlin, and for which Messrs. McLaughlin and Lord made great claims.

MORRIS, TASKER & COMPANY, of Philadelphia, were in evidence in their chocolate colored price list of electric light and trolley poles. Engineer S. B. Wheeler made a splendid representation.

F. A. ANGEL, of the National Malleable Casting Company, Chicago, showed a line of malleable castings of overhead material, rail braces, rail chairs and a line of general castings for street railway work.

M. E. BAIRD, general agent of the Eddy Electric Manufacturing Company, of Windsor, Conn., was one of the busiest men at the convention. His company is doing a big business and certainly deserves to.

A FAVORITE RESORT FOR WEARY DELEGATES.

CRAWFORD'S STREET CAR FENDERS, manufactured by the R. A. Crawford Mfg. Co., Pittsburg, Pa., were well exhibited by the inventor, and closely examined by different managers.

J. S. PARTRIDGE had a neat display of carbons manufactured by the Partridge Carbon Company, of Sandusky, O. Mr. Partridge cannot help but make customers even without half trying.

"OKONITE" was, as usual, well represented. Capt. Willard L. Candee, who was present in person, seems to grow more popular with the march of time, while Okonite keeps a close second.

W. F. NEWBERT came all the way from Chicago to remind the delegates that Griffin car wheels could be had at the old stand. Mr. Newbert's address is now the Western Union Building, Chicago.

THIEL'S DETECTIVE SERVICE was represented by Proprietor G. H. Thiel in person, and Mr. C. M. French, manager of the Chicago office. This bureau make a specialty of work for street railway corporations.

THE SCARRITT CAR SEAT COMPANY, of 941 Rookery, Chicago, sent Mr. H. O. Nourse, who kept his firm's name to the front. His "Coons in the Corner" were highly appreciated by members and lady visitors.

WM. HAZLETON, 3rd., enjoyed the distinction of being the only representaitve of a foreign enterprise. He now represents Les

ONE OF THE MOST COMPLETE DISPLAYS.

Etablissements Arbel, of Loire, France, manufacturers of wrought iron forged center for car wheels.

THE GUARANTOR'S LIABILITY INDEMNITY COMPANY, of Pennsylvania, whose head office is at 435 Chestnut street, Philadelphia, presented the delegates with a card case of black as a souvenir of the convention.

"THESE ARE OUR JEWELS" was the simple sentence on an artistic pamphlet that introduced the reader to some of the notable plants equipped with Heine boilers. Col. E. D. Meier, president of the company, was present in person.

THE CHICAGO TRUCK COMPANY were unfortunate in that the railroads failed to get their truck to the building on time. However, vice-president George H. Graham was on hand, and did much to increase the fame of this truck.

COOK, FROM CHICAGO, whose initials are W. J., and whose name every one knows, represented the McGuire Mfg. Co., and attended to its exhibit, while Philadelphia Agent Hanna did much to advance the renown of this truck.

THE BERLIN IRON BRIDGE COMPANY, of East Berlin, Ct., rather broke the record for Convention exhibits by erecting a model power station that aroused great interest. Mr. John M. Field was in charge.

"KERITE" insulated wire was ably and effectively represented by F. G. Fuller known to fame as "Pop" Fuller, who

distributed to delegates and distinguished visitors a handsome pocket note book as a souvenir of the occasion.

E. C. DARLEY came from St. Louis to impress upon the delegates the good qualities of the Rankin & Fritsch engine. This is the giant engine in use at the power house of the Atlanta Consolidated Street Railway Company.

GARTON & KNIGHT MANUFACTURING COMPANY, of Worcester, Mass., distributed neat invitations to visit their store on West Alabama street to examine a line of their belting, and many of the visitors accepted. Mr. Harry W. Anderson was in charge.

STILLWEL-BIERCE & SMITH-VAILE COMPANY, of Dayton, O., had an artistic display of pumps, and of the new friction clutch just placed on the market. The exhibit was made by Mr. J. W. Taylor, southern agent, and attracted much attention.

Model Power Station.

THE WIGHTMAN BLOCK SIGNAL for electric railways, was shown in operation. This is manufactured by Wightman & Co., of Scranton, Pa., and consists of signals practically the same as electric signals on steam roads. It was unusually interesting.

BENEDICT & BURNHAM, as every one admitted, made one of the best displays of rail bonds and railway wire ever attempted at a street railway convention, and in consequence had the satisfaction of a visit from nearly every delegate.

EDWARD E. HIGGINS, a familiar and popular convention character, journeyed from New York to greet old friends. As is well known, Mr. Higgins is now an expert in street railway values and economies, with an office at 26 Cortlandt street, New York.

A FLEXIBLE ADJUSTABLE BRACKET of new and improved design, was described in suitable literature circulated by the Wrought Iron Bridge Company, of Canton, O. Many inquiries were made for a representative of this well-known firm, but he did not arrive.

THE GENETT AIR-BRAKE was especially prominent. The musical toot of its whistle on the cars equipped and running, its handsome display in the hall, and the hustling of General Manager E. J. Wessels kept every one reminded that air-brakes were here to stay.

THE NILES TOOL WORKS had one of their great tools so arranged that visitors could not help but see all of its features. Many were pleased to examine an exhibit from a firm which has supplied so much machinery to those in the electrical industry.

"THE BOOSTER SYSTEM" and other electric railway information was supplied by Mr. J. H. Vail, of the Electrical and Mechanical Engineering and Trading Company, of New York. If any one missed this choice bit of literature he should now send for a copy.

THE NEW HAVEN CAR REGISTER made an unusually handsome display. Vice-President and General Manager F. Coleman Boyd was kept busy "ringing up" to show the features of his clever device, in addition to handing out a much-valued souvenir—a mirror paper-weight.

MR. A. L. REGISTER, representing Pepper & Register, of Philadelphia, and one of the rising young men of the industry, grasped the hands of many who have long known him. The Technic Electrical Works, in which he is interested, was directly represented by H. T. Stewart.

THE WESTERN TELEPHONE CONSTRUCTION COMPANY had a very graphic exhibit of their magneto telephones, and Manager Stitch proved himself a capital convention worker. It will be strange if many orders do not follow as the result of his energetic work.

THE STREET RAILWAY REVIEW furnished a good example of its usual Western enterprise in distributing among its friends at the convention a very handsome souvenir number which was well gotten up and reflected great credit on the representative of the street railway interests in the West.

THE WALLACE ELECTRIC COMPANY, of Chicago, in the person of Mr. Max Berg, had a very kindly reception from every one. Their display consisted mostly of a handsome pamphlet describing Wood's street railway specialties, Habirshaw wire, etc. Hundreds of copies were well distributed.

MR. CHAS. O. LENTZ did the honors for the Graham Equipment Company, of Providence. The Graham truck has made great headway of late, one of the most gratifying orders being for 8 trucks given by the Consolidated lines of Atlanta; 4 of these were in service during the Convention, the others being on the ground.

JACKSON & SHARP, one of the oldest car-building firms in the world, which has recently taken up street car building, were represented by President J. H. Jackson and Mr. Geo. E. Pratt. Several of the cars manufactured by this company were in service during the convention. That they were admired goes without saying.

MR. RICHARD O. HEINRICHS, in a neat bit of literature issued by the Weston Electrical Instrument Company, of Newark N. J., announced that he was ready and would be happy to discuss the merits of this prominent type of measuring instrument. If you didn't get one of these little pamphlets send for a copy; it is interesting.

THE FALK MANUFACTURING COMPANY, of Milwaukee, showed great wisdom in sending Mr. G. Hoffman to the Convention,

Popular Overhead Material.

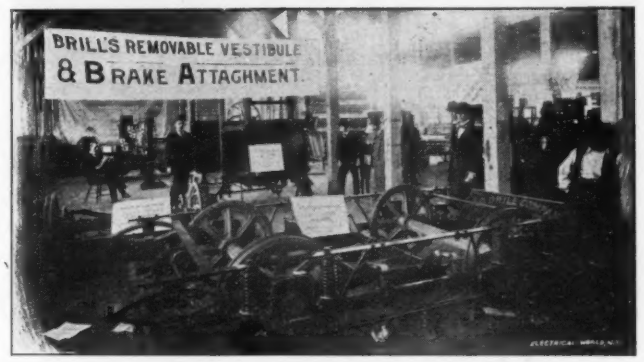
for he proved to be one of the greatest hustlers of the meeting. His exhibit had a continual stream of visitors, and his arguments were just the thing. His trolley will hereafter be much better known.

THE FIBERITE COMPANY, and the Mason Electric Company had made arrangements for the joint display of a very handsome line of Medbery overhead specialties. To their bitter disappointment they found that the shipment had been delayed, and in

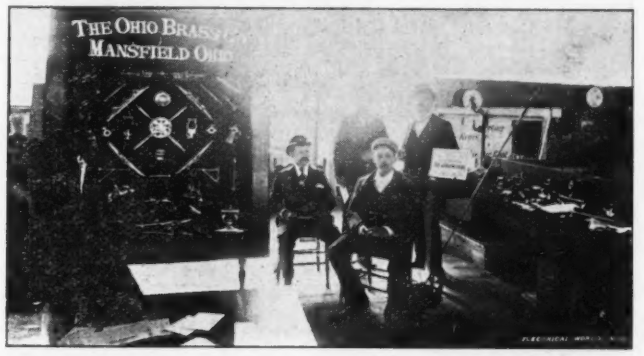
consequence the many callers did not see specimens of this well-known material. The Medbery insulation has long been popular with street railway managers.

THE VAN DORN AUTOMATIC DRAWBAR was exhibited by the inventor, Mr. W. T. Van Dorn. This device has been seen at all the recent street railway conventions, and has become a standard. One of the latest orders taken by the Fitzgerald-Van Dorn Company was given by the Metropolitan West Side "L" road of Chicago. Their address is Lincoln, Neb.

THE WADHAMS OIL & GREASE COMPANY, of Milwaukee, Wis., happily remembered from the convention in that city last year, made a good display of Wadhams' curve grease,



THIS EXHIBIT CREATED UNUSUAL INTEREST.



ONE OF THE MOST COMPLETE DISPLAYS OF SPECIALTIES.

as well as of their high grade dynamo and engine oils. E. A. Wadhams and G. A. Streeter attended to the exhibit and were among the busy workers.

THE "JEWEL" BELTING COMPANY, without which a convention or exhibition of any kind would be incomplete, made a very neat display of dynamo belting. This embraced a section of their 69-inch 3-ply belt that has transmitted 1,540-hp at a speed of 5,260 feet per second. Their souvenirs, handsome snake-skin card-cases, were much sought after and highly prized.

THE OHIO BRASS COMPANY made a very creditable display of their overhead railway specialties. They had a full line of samples, together with a very attractive souvenir, and a particularly good representative in the person of Mr. C. K. King, manager of the company, and a man thoroughly well known for his painstaking and conscientious work.

THE ELECTRICAL REVIEW took advantage of the occasion to distribute to the delegates a special number devoted to street railway interests which contained much interesting and valuable matter. To distinguish this number from one of its regular issues the covers were printed in red ink, which imparted to it a very striking and conspicuous appearance and excited favorable comment on the part of those present.

THE PAIGE IRON WORKS, of Chicago, had the largest exhibit in the building, its total floor space being more than 1,200 feet. It embraced a line of sample Shanghai and T-rails for paved streets on steel ties, and also girder rail work in all varieties. President Paige was himself in charge. Their tribute to the souvenir collectors was a handsomely nickeled section of rail for a paper weight.

THE STIRLING WATER TUBE BOILER had a most unique exhibit. It consisted of a model boiler in which, through glass openings, the circulation of water (heated by a spirit lamp) was plainly seen. President Degan had no difficulty in securing the close attention of the visitors that came his way. The Stirling, by the way, was recently adopted by the West Chicago City Railway Company, the order being for 8,000-hp.

THE PENNSYLVANIA STEEL COMPANY, of Philadelphia, Pa., which, by the way, was the first firm in the United States to roll a steel rail, had a substantial display of sample rail sections, steel railroad crossings (recently adopted by the Pennsylvania Railway), "T" and girder rails, etc. Treasurer E. M Smith, Manager J. F. Ostrom, C. S. Clark and M. D. Pratt were the representatives present.

THE BASS FOUNDRY & MACHINE COMPANY, of Fort Wayne, Ind., occupied a favored position in the centre of the hall. P. F Leach had matters in charge. His display included a full line

NEW 750 H-P UNIT AT CONSOLIDATED POWER HOUSE.

of car wheels. Among them were specimens of the famous "Cushioned" wheels for electrically driven cars, about which much has been said. This firm also make Corliss and other types of engines for power stations.

THE CENTRAL ELECTRIC HEATING COMPANY had a full line of their different types of electrical heaters, and Mr. Edward B. Wyman, manager of the street railway department, had his hands full at the convention and closed several nice orders. As electric heating has been indorsed by the most progressive managers, it is now only a question of the system to be selected.

W. E. HAYCOX, president and general manager of the Fulton Truck and Foundry Company, now of Mansfield, O., was one of the busiest men in the Exposition hall. His exhibit embraced a

motor truck, car wheels, ticket destroying machine and a motor lift in operation. Mr. Haycox discovered during the convention that his firm holds a warm place among street railway men, and is certain to make many friends in the future.

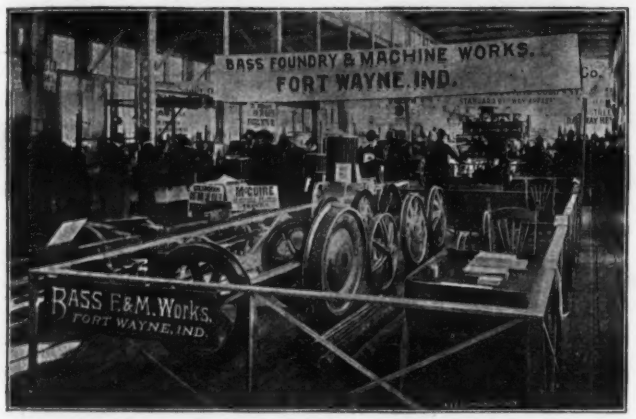
SPERRY'S ELECTRIC BRAKE was certainly one of the principal novelties of the convention. It was in operation on one of the Sperry cars, and was under the personal direction of the inventor, Elmer A. Sperry. L. A. Rogers, general manager of the Sperry Electric Railway Company, circulated one of the brightest bits of literature found at the meeting, in which the Sperry system was clearly described, and in addition did much for the advancement of the company's interest.

CHAS. A. SCHIEREN & COMPANY, represented by young Mr. Schieren, so popular at all conventions, gave away one of the neatest memorandum souvenirs at the convention. It was a handsome book, on the celluloid covers of which was a picture of Schieren & Co.'s Bristol, Tenn., tannery, where all their oak tanned belting is prepared. This establishment, situated but a short distance from the convention city, has a capacity of 200 hides per day and is rated one of the largest tanneries in the world.

THE CONSOLIDATED CAR HEATING COMPANY had a well arranged and complete display of their car heaters. The form of this type of electric heater is already well-known to our readers. Inventor McElroy volunteered the information, however, that although his company gave a two-year guarantee they had apparatus in for the past three years that was giving excellent satisfaction, and were now able to give that guarantee. Western Manager E. A. Smith and Engineer H. N. Ransom were also in attendance.

THE STREET RAILWAY JOURNAL this year renewed its custom of distributing to those attending the convention a souvenir edition which was a model of artistic and typographical excellence. Filled with interesting and appropriate matter, handsomely illustrated and printed on heavy paper, it will undoubtedly be preserved by many present as a reminder of one of the most successful and enjoyable meetings ever held by the association. The Journal is to be congratulated on the fine appearance of this souvenir number.

THE JOHNSON COMPANY, of Johnstown, Pa., were, as usual, one of the best represented companies. Their exhibit embraced samples of their steel rail construction, as well as one of their new and improved Dupont Trucks about which much has been said in praise. The immortal three—Coolidge, Littlefield and Evans—were everywhere, and no delegate in need of rails or trucks escaped them. The "Major" was the central figure of Atlanta during the meeting, and startled the Southerners with his chrysanthemum and his wit.



Cushion Car Wheels in Profusion.

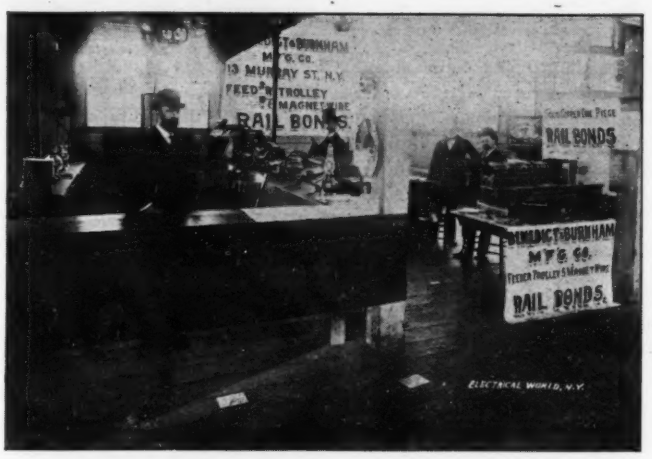
Where Street Railway Men Left Car Heater Orders.

Most Notable Truck Display.

"MICHIGAN OVERHEAD MATERIAL" was displayed on a neat sample board bearing the legend "A Line of Reliable Material Designed by Practical Men." President Jos. E. Lockwood of the Michigan Electric Company, Detroit, Mich., was present and in charge of the exhibit, which included span, barn, bracket, swinging, and curve ranges, switches, cross-overs, strain plates, section insulators and pull-offs. This company also exhibited a radical

departure in the way of a signal light for electric cars which was much admired.

C-S AUTOMATIC CUT-OUTS were neatly displayed, and graphically described on a card in which it was stated that where these cut-outs are used the fiendish practice of reversing the controller to stop a car, popular with lazy conductors, is impossible for the reason that this magnetic cut-out immediately located the man and the car. The visitors were advised not to use the C-S automatic cut-out "if you don't care to save your apparatus." W. E. Harrington and C. E. Bibber did the right thing for every one.



WIRE AND RAIL BOND BOOTH.

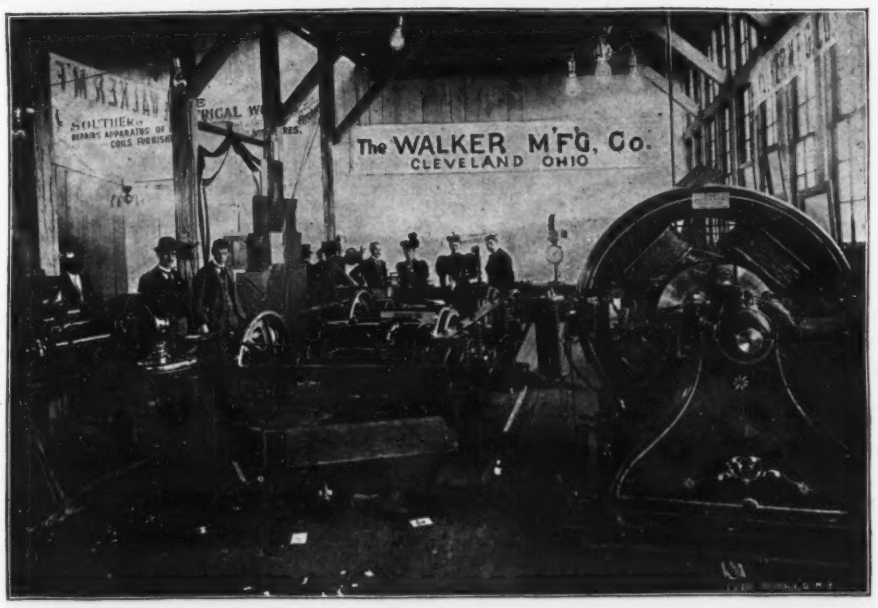
NEIGHBORLY DISPLAYS.

THE CARD ELECTRIC COMPANY, of Mansfield, O., had a very well arranged display in a good location. It consisted of one 35-hp double motor equipment mounted on trucks, and another 25-hp motor open for inspection; multiple series controller device for turning down commutator without taking commutator out of motor case; new fuse plug and new magnetic switch. Inventor Card, President Reid Carpenter and Superintendent J. F. Card were in constant attendance, and were all kept busy answering the hundreds of questions concerning what has been termed "the newest comer into the motor field."

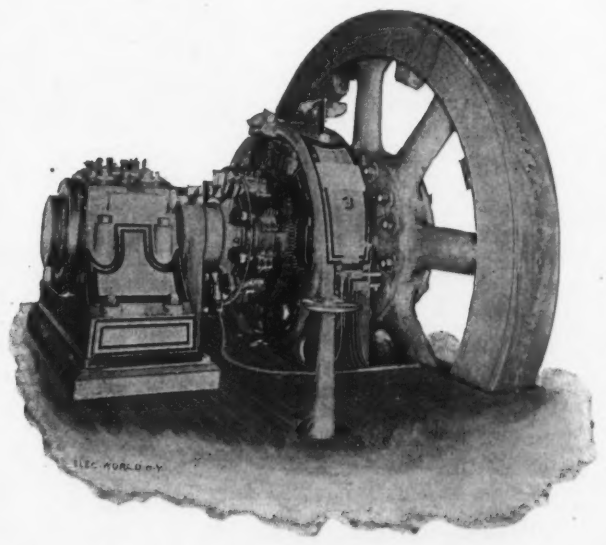
PECKHAM'S TRUCKS were much in evidence. The literature devoted to this popular truck was unusually handsome and complete, while the display in the exhibition was very interesting. It included one standard and one extra long centilever extension truck; also interchangeable wheels, wheels on axles, and independent, flexible gears and a model of a truck. President Peckham was himself kept constantly on the go attending to details and talking with delegates. His staff consisted of W. E. Cook, engineer, and W. H. Wilkinson, superintendent. In addition the visitors were kept aware of the fact that Peckham trucks were in use under the Sperry exhibit car, and the great long Jackson & Sharp car, both in service.

JOHN G. BRILL, than whom there is no better known or more popular man in the car building industry, and whose company is always prominent at events of this kind, had much to do, as his exhibit was very complete. In the hall was shown a sectional end of closed car in natural wood, removable vestibule, brake ratchet lever and brake ratchet windlass, rotary gong, track scraper, sand box, gates, life guards and fender, all of Brill's latest pattern. One Eureka Maximum Traction and one No. 21 B truck were shown. The street exhibit consisted of an 18-foot car on No. 21-truck, a 20-foot car on Eureka truck, and a combination open and closed car, all in operation. The representatives of the firm in addition to Mr. Brill were F. C. Randall, western selling agent, S. M. Curwen, M. E. Curwen, Geo. M. Haskell and Wm. H. Heulings, Jr.

MR. A. J. WURTS, at the Westinghouse Company headquarters at the Aragon Hotel, performed some striking experiments to illustrate the principles upon which is based his system of protection against lightning, showing among other things how to make lightning and how to handle it. Having it ready made in the clouds he showed how it could be controlled and also showed how the appliances heretofore used for that purpose might accidentally do some good but how they probably might do no good whatever. He made a disruptive discharge pass across a five-inch space over a surface, that would not pass through an air space of more than about three-quarters of an inch, and illustrated other peculiarities, eccentricities or vagaries, whatever name is proper, that govern or do not govern the manner in which disruptive discharges take place along a line, for sometimes



THE BRIGHTEST EXHIBIT AT ATLANTA.



750-HP GENERATOR AT CONSOLIDATED POWER-HOUSE.

they take place where an ordinary man would suppose, while sometimes they go where nobody would ever expect to find them except possibly Mr. Wurts himself, who has made the erratic freaks of lightning a special study, both in the laboratory and in the field.

THE WALKER MANUFACTURING COMPANY, of Cleveland, certainly had the most attractive exhibit in the building. Happily situated by the main entrance, it was admirably planned and well managed. It consisted of a 200 hp generator, complete motor truck with two 30-hp spring mounted motors, two series parallel controllers, rheostats, lightning arresters, fuse boxes, cut-outs, switches and everything that goes with an electrical equipment. One of the best features of the display was the demonstration of the value of spring suspension, a feature that greatly reduces the pound at rail joints. In addition to this the company distributed a handsome pamphlet illustrative of the lines now equipped with Walker apparatus, and of the immense factory at Cleveland. Inventor Sydney Howe Short was in charge. Manager. W. H. Bone was busy at all times, while H. McL. Harding, an old street railway man, met friends at every turn. Other representatives of the company were B. M. Barr and Jas. Atkinson, selling agents at Cleveland, and the Kohler Bros., Chicago agents. Altogether the Walker Company made a most pleasing impression at the Convention.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY needed no other exhibit than that afforded in the powerhouse of the Consolidated Company, to which place the entire convention adjourned on Thursday where they saw a 750-hp Westinghouse generator started up successfully. The illustration of this, given elsewhere in this issue, afford the best possible description of it. It is needless to say that the delegates were highly pleased, and many were the compliments showered upon the Westinghouse system. A notable feature of their convention efforts was the lecture given by Electrician A. J. Wurts in their room at the Aragon; Press Manager Heinrichs was busy as usual looking after the interests of his company. The other representatives were Wm. F. Zimmermann, assistant general manager, New York; W. C. Clark, general agent, Pittsburgh; B. F. Stewart, district manager, Chicago; G. Pantaleoni, district manager, St. Louis; C. A. Bragg, district manager, Philadelphia; D. A. Tompkins, district manager, Charlotte, S. C; J. A. Rutherford, salesman, Pittsburgh, and I. R. Gordon, salesman, Charlotte.

THE GENERAL ELECTRIC COMPANY, as usual, had a very artistic and comprehensive display of street railway devices in the centre of the hall. This consisted of a full line of overhead material, underground feeder tubing, different forms of controller, generator and feeder panels, current cut-outs, the "Thomson" arc lamp, and the Thomson recording wattmeter, together with quite an extensive line of literature. The best feature of the General Electric convention display, however, was the apparently great number of G. E. 800 motors in use on the lines of the Consolidated. It seemed as though every car bore the statement that this type of motors was in service on that particular car. Its corps of representatives was large and effective. W. J. Clark was in charge, and was ably assisted by J. K. Lovejoy, manager of the supply department, H. C. Wirt, assistant; A. K. Baylor, assistant to Mr. Clark; T. P. Bailey of the Chicago office; Geo. D. Rosenthal, St. Louis office; W. B. Potter, H. J. Crowley, H. H. Corson, D. B. Bullen, A. F. Giles and J. E. Hoffman. The headquarters of the company at the Kimball House during the convention was one of the most popular corners in Atlanta.

WOODRUFF AND ELLIOT, of the Consolidated Street Railway Company, were much complimented upon their success in installing and starting up the new 750-hp engine and generator during the convention and in presence of a large body of delegates. The engine and dynamo do not form a direct connected equipment in the sense of having the dynamo shaft and the engine shaft coupled. In this case the armature of the generator is built upon the main shaft of the engine, which is of the Corliss compound condensing type, the fly wheel of the engine being also on the same shaft. The shaft was made in St. Louis by the Rankin-Fritsch Engine Company and the armature in Pittsburgh by the Westinghouse Company. When the separate contracts were made nothing was said about who should put the armature on the shaft. The engine people did not wish to assume the responsibility connected with undertaking it. It would be expensive to ship the shaft to Pittsburgh to have it done there, and Messrs. Woodruff and Elliott finally determined to undertake to put the armature on the main shaft in Atlanta. This was accomplished, and the opinion of experts who examined the work was that it has been quite as well done as it could have been in a big shop with ample facilities, such as no power house could afford. The starting up of this big unit was one of the events of the convention and was celebrated by a lunch given by the Consolidated company to about one hundred invited guests, being served immediately after the machinery was put in operation, by the year-old son of Mr. Joel Hurt.

AMONG OTHER COMPANIES represented at the Atlanta convention, some of whom, however, had no exhibits, were: The American Electric Manufacturing Company, J. F. Gerliman, St. Louis; Abendroth & Root Manufacturing Company, P. McLaren, general manager, New York; Buckeye Engine Company, G. A. Barnard, Salem, O.; G. L. Colgate, New York; C. L. Cornell, Hamilton, O.; Chapman Valve Mfg. Co., E. L. Ross, Indian Orchard, Mass.; Car Equipment Company, E. H. Allen, Philadelphia; Columbia Incandescent Lamp Company, J. H. Rhotehamel, president, St. Louis; Dorner and Dutton Manufacturing Company, J. L. Pugh, Cleveland, O.; Electric Railway Equipment Company, S. J. Nick, Cincinnati; Georgia Equipment Company, J. Regenstein, W. Brooks, C. E. Fairbanks, Atlanta, Ga.; Hoppes Manufacturing Company, W. H. Fisher, Springfield, O.; Morris, Tasker & Company, C. F. Flanders, S. Bowman, Philadelphia; New York Electric Works, C. W. Van Fleet, New York; New Process Raw Hide Company, A. C. Vosbaugh, Syracuse; New Haven Car Register Company, F. C. Boyd, J. S. Bradley; Pettingell-Andrews Company, F. X. Cicott, Boston; Rochester Car Wheel Company, F. D. Russell, Rochester, N. Y.; Robinson Radial Car Truck Company, W. Robinson, Boston; Standard Underground Cable Company, F. G. Degenhardt, Pittsburg; Stanwood Manufacturing Company, F. H. Stanwood, Chicago; St. Louis Register Company, J. W. Allison, St. Louis; Vacuum Oil Company, E. A. Record, Boston.

THE JOHNSON COMPANY'S SPACE—WHERE NOTABLES GATHERED.

The T-Rail Track Construction of the Terre Haute Electric Railway.*

BY RUSSELL B. HARRISON.

The first T-rail was laid by the Terre Haute Electric Railway in the fall of 1890 and with a little judicious explanation of its merits to the Mayor and Aldemen met with no opposition. This was a 40-pound rail, laid on oak ties 5x7x7 inches, three feet from centre to centre. It was found that planking was unnecessary and that gravel was much more satisfactory.

In 1892 the city began paving the streets and their experience with the T-rail had been so satisfactory that it was decided to continue its use. About this time the Illinois Steel Company brought out their sixty-pound Shanghai T-rail, and as it was five and three-quarters inches high, permitting paving without chairs and direct spiking of the rail to the ties, it was very promptly adopted and ordered. Carefully selected oak ties 5x7x7 were used.

In the fall of the same year it was necessary to lay T-rails in an asphalted street. The asphalt was brought up to and in contact with the rail on the outside for the entire distance of half a mile. On the inside for the first half mile the vitrified brick used with the corner cut off on a sloping angle, was used to give flange space, and between the two ends of the brick asphalt was used in the regular way. On the last mile the Haydenville blocks were tried but they were found not to have the wearing qualities of brick.

The company also had experience with T-rails in streets paved with bricks.

Attention was then given to the following improvements. (1), to use a heavier rail with wider head; (2), to substitute metal glass-ties for wood; (3), to secure greater rigidity and evenness in rail ends; (4), a firm and permanent hold on the rails without the use of nuts and bolts; (5), in paving, a better brick and of such shape as would provide better flange room and contact with the web of the rail. These changes brought the company to an all steel T-rail track.

A description of this modern track construction in detail may prove of interest.

Rail—When the Illinois Steel Company brought out the seventy-two pound Shanghai T-rail, which was an improvement both in weight, strength and in the width of the head of the rail over sixty Shanghai T-rail of same make, it was immediately adopted as the company's standard and was used in our latest and best T-rail track construction. The rail is six inches high, the base is five inches wide, the top or head is two and three-eighths inches in width. The web from where the turns begin is three and one-half inches. The long web permits the rail to rest on the ties and brings the top of rail to proper level for paving with brick, asphalt or granite blocks. In this track the rails are laid broken jointed. The seventy-two pound rail has a wider head which gives better contact, and wider bearing service for the wheels. The edges of the wheels do not nick or chip out as with the lighter rails with narrower heads. Experience with the narrow head rails demonstrates that by wear an outer flange is formed on the wheel and that this outer flange is very destructive to the life of special work and the wheel. The wider rail head is also better for gravel or macadamized streets, as it gives no opportunity for the stones lying adjacent to the rail to nick the outer edge of the tread of the wheel.

Foundation—The foundation of a track is to a larger degree than any other part responsible for its wearing qualities, and this fact has not been lost sight of in our work. Good rails, ties and joints cannot alone make a track or properly sustain it so as to keep it level and give good wearing qualities; therefore under the all-steel track it was determined to place a heavy foundation of the best material. After the necessary excavation the ground was rolled with a heavy fourteen-ton steam road roller. Then eight inches of broken stone concrete was placed in position and allowed to set. Then the rails, ties and joints were distributed and connected together and when the track is completed it is brought to the required grade or level by putting blocks under the rails at intervals to bring track to proper grade. Then four inches of broken stone concrete is tamped under the ties and under the rails. After the tamping process is completed the inequalities of the surface are filled with concrete and the whole leveled up with concrete over the top of the ties and pounded to a level surface with a wooden rammer and allowed to set.

Ties—The ties are steel and double corrugated and heavily coated with tar while hot and being made, are two inches high, seven inches wide and seven feet long for straight line work, and were laid fifteen inches between centres. For special work the ties vary in length as the necessities require, up to twenty feet or more. The metal of the tie is one-half inch thick. These ties were manufactured by the Daniels Steel Tie Company, of Youngstown, O. The rails rest on and are fastened to the ties by clamps with off-sets to fit the base of the rail. These clamps are secured and adjusted to the top of the tie by special made bolts with oval shoulder and inserted from bottom of tie with the head below and the nut on top, which permits a powerful box wrench being used to draw the nuts on bolts to a permanent position. In using these steel ties in connection with the Wheeler rail joint a mechanical difficulty arose, but was overcome in the following way after some study: The Wheeler joint has a thickness of three inches below the rail base, and in laying track with broken rail joints a straight tie would not answer. At first we thought it would be necessary to use a wooden tie under rail joints, but by devising a special tie, we were able to have them all of metal. The special steel tie for use under joints was adjusted to the necessary levels, by bending it down in the centre three inches by an easy off-set. In laying the track these special ties were easily placed in position and gave perfect satisfaction. The clamps and bolts were the same as on straight line work.

Joints—A great deal of attention was given to the subject of securing a good rail joint for this all-steel track, and after examining many devices we selected the Wheeler rail joint made at Marion, Ind., as it did away with the bolts and nuts, and embodied the best of all mechanical principles—that of the wedge. These joints at that time had not been made for Shanghai rails or for steel ties, but I overcame these difficulties by designing a new joint to be used with these rails and ties, and secured in this new pattern more bearing surface on the tie, by having the bottom of the joint made to fit the corrugations of the tie. The joint consists of two parts, one of which is keyed on to the other. The larger or heavier part used on the outside of rail has two lugs, that fit in the angle joint holes nearest the ends of rails. After it is placed in position, the lighter part is keyed on with a large maul and it holds the rails rigid. Then the tie is placed under joint and is fastened to it in the regular way, with the exception that the clamps have longer off-sets, the holes in the ties for the bolts are also wider apart, on account of the width of the base of the joint. The joint has corrugations on each side at right angles to the rail, which gives it great strength. The joint is made of the best malleable iron and weighs thirty-two pounds complete.

Bond and Supplementary Wire—Iron wire, having proved unserviceable and unsatisfactory, the heaviest copper wire was used in connection with this steel track. Double bonds of No. 0000 copper wire were used at each rail joint, one in the upper and one in the lower part of the web of rail. These bonds were soldered and connected to the No. 00 tinned copper supplementary wire, that has been adopted as standard.

Paving—When the foundation is completed and the track set in it, as just described, nothing remains but the paving to complete the track and street for use. The all-steel track was laid on 9th Street, a business street leading from Wabash Avenue or Main Street to the Union Depot, and brick was, therefore, selected for the paving material. As the use of Haydenville block has been abandoned and the angle, nose-cut brick did not touch the web of the rail, I designed a special shaped brick that has many advantages, combined with the same wearing qualities as the brick on each side of the tracks.

Drainage—In the centre of each track, at the lowest point in the grade of each street, an eight-inch sewer pipe was laid to the sewer. Over the top or opening of this pipe, in the center of the street, is placed a small catch basin surmounted by a special made iron grating. The water flowing down the track and along the side of the rails, is thus rapidly removed and a simple and effective drainage secured.

Injury to Track by Vehicles and Heavy Teaming—On our track, which is standard gauge, four feet eight and a half inches wide, heavily loaded vehicles cannot drive along it and get the benefit of the smooth metallic surface as in the case with girder rails. This condition is a great improvement, and makes a saving in many ways. First: It saves an immense amount of money in repairing the injury and wrenching to track, and rapid wear and tear thereto caused by vehicles, and particularly heavily loaded wagons running in and out and driving along the track. Second: It permits a quicker and more frequent service.

To further prevent heavy teaming along the flange spaces of our track, and at the same time make the wear and tear on the street paving, which we are required to maintain, a minimum, an ordinance was passed by the City Council "Regulating Heavy Hauling Over and Through the Improved Streets of the City of Terre Haute."

* Abstract of a paper presented at the Atlanta Meeting of the American Street Railway Association.

Can the T-Rail be Satisfactorily Used on Paved Streets?

In presenting his report to the Atlanta meeting of the American Street Railway Association Mr. Strathearn Hendrie stated that the word "satisfactorily" had been considered as applying to the point of view of the city and driving public as well as that of the company. The tendency of the larger cities, and in fact of all cities in this country during the past 10 years or more, has been toward smoother and better paved streets which has resulted in a demand, both by the public and city officials, for improved forms of rails. Following the example of foreign cities many city officials have forced the street railway companies either to use the English grooved rail or its American modification, neither of which, however, has proved satisfactory to the railway companies. For the street railway man questions of price, joints, quick delivery, competition, coal and construction combine to recommend the T-rail. The old argument for the tram head—that the steel paving for three inches is the cheapest in the end—no longer holds good, and wagon traffic goes, where it belongs on the side of the street. The suggestion of a T-rail is generally startling to the average citizen, alderman and city engineer, but their idea of such a rail is that used by steam roads and projecting four or five inches above the street. It is necessary to convince them that there is more than one way of putting a rail in the street.

As an appendix to the report a list of 26 cities in which the T-rail is used is given with remarks thereon, from which it is apparent that the general concensus of opinion of these roads, and of the officials of the cities in which they run, is that if 100 yards of T-rail can once be laid with good paving neither the officials nor the citizens would permit the use of anything else in the future. The paving is perhaps the most important point. Modern street railway construction and street paving imply broken stone, concrete or other solid foundation, a high girder or T-rail and a brick, asphalt or granite surface to the street in larger cities, or cedar blocks, cobble or macadam in the smaller ones. Asphalt or macadam can be paved as easily to a T-rail as to any other. They should be laid flush and room should be made for the flange by running a railroad freight car or other car having a larger flange than the street car over the track before it is open for traffic. Bricks are now molded by many manufacturers to fit girder and T-rails. Whether it is more expensive to chip the corner of granite or Medina blocks, or to leave them intact a short distance from the head of the rail and fill the place made with asphalt, creosoted wood or concrete is an open question.

It may be useful in arguments with city officials in favor of the T-rail as against a grooved girder to insist that the T-rail is a girder rail with a head, differing less from that of the grooved girder than this does from the tram or centre bearing head; also that the substitution in this country of the steel brace and upright member of a girder for the wooden stringer took place before the introduction of the grooved rail, and was due to entirely different causes. The girder is an established fact; its grooved head, it is hoped, is merely a passing fancy.

A System of Taxation.

Mr. Allen Ripley Foote read a paper before the Atlanta meeting of the American Street Railway Association, on taxation, in which, after the economic principles concerned are discussed, a system of taxation is proposed.

The system provides that all property, including exchangeable products upon which labor has been expended and the ownership of which is protected by law, shall be assessed for taxation at full value, but that securities representing the ownership and value of property shall not be taxed. No other than a property tax shall be levied upon any industry, business or vocation. The Legislature may exempt the whole of any class of property from taxation, and special assessments may be made for special benefits, accruing from public improvement, upon all property securing an increment of value by such improvement. The system also provides a method for carrying out its details.

An Atom of Electricity.

According to a recent determination of Prof. Richarz, the smallest possible quantity of electricity, which may be termed an atom of electricity, is such that 430 multiplied by a million three times, that is, by the cube of a million, will give the number of these atoms contained in a coulomb. That such a thing as an atom of electricity exists is the opinion of no less an authority than Prof. Von Helmholtz.

Classification of Street Railway Expenditure.

At the Atlanta Convention, Mr. H. I. Bettis submitted the report of the committee on "A Standard Form of Street Railway Accounts" which includes a classification of expenditure. The report states that while the classification is not sub-divided to the extent that some might think desirable, yet it is sufficiently so for practical purposes, and that any further division would only serve statistical and not business ends.

The classification is under two general heads, "Construction and Equipment" and "Operating Expenses," the former comprising twenty items and the latter thirty-two; operating expenses are under four sub-heads, "General Operating Expense," "Transportation Expense," "Maintenance of Way and Buildings" and "Maintenance of Equipment." Below we give the various items, with explanatory notes:

CONSTRUCTION AND EQUIPMENT.

1. Superintendence and Organization Expense.—Salaries of superintendent of construction, assistants, wages of clerks and others employed in the offices of this department. Expense of the office, furniture, fuel, lighting, supplies for office, miscellaneous and personal expense of superintendent and assistants while on business. Includes stationary and printing for this department. Also all expenses of organization not coming under either of the following heads:

2. Engineering.—Wages and expenses of engineers and draughtsmen on preliminary and construction work.

3. Right-of-Way.—Salaries and expenses of right-of-way agent, together with payments for rights of way, easements, franchises and pole rights.

4. Building Construction.—Cost of buildings; car houses, stations, offices, store houses, power house, repair shops, wharves, coal sheds, etc., etc.; also furniture and fixtures for the same. To this account should also be charged the cost of land occupied by the buildings mentioned. Real estate (land and buildings thereon) not used by the road for actual operation must be charged to Real Estate Account.

5. Track and Roadway Construction.—Includes the expense of grading, surfacing, ballasting, ditching and paving; the cost of rails, rail chairs, ties and stringers, tie rods, joint fastenings, track spikes, frogs and switches, supplementary wire, tie wires, channel pins, solder and miscellaneous track material; also the cost of distributing and laying the same, with the supplementary wire and its connections.

6. Overhead Construction.—Cost of poles and setting; putting up trolley, feeder and guard wires, including cost of wire and all devices for overhead construction.

7. Car Equipment.—Cost of cars built or purchased, including the cost of trucks, wheels, motors, upholstering, painting, lettering, varnishing, &c.

8. Snow Plows and Sweepers.—Cost of snow plows and sweepers built and purchased, including the electrical equipment for the same.

9. Power Station Equipment.—Cost of steam plant, engines, boilers, pumps, piping, shafting and belting, dynamos and switchboard equipment, together with installation of the same.

10. Tools and Machinery.—Cost of tools and machinery for repair shops, car houses, &c., and expense of setting and placing in running order.

11. Improvements and Betterments.—All expenditures which improve the *original plant*, and of which a portion should be charged to operating, and a portion to construction expenses.

12. Real Estate.—All land and buildings thereon purchased as an investment and not used by the road for actual operation.

GENERAL OPERATING EXPENSES.

21. Salaries of General Officers and Clerks.—In this account are included the salaries of the general officers; the heads of departments connected with the supervision and management of the general business of the road. Salaries of division superintendents and assistants may also be charged to this account. By general officers are meant officers in charge of departments, and whose jurisdiction extends over the entire road. This account embraces the salaries of all clerks in the general offices, clerks for heads of departments, and all clerks not herein after mentioned.

22. Miscellaneous Expense General Offices.—The expense of heating and lighting the general offices; wages of porters, messengers, etc., telephone service and all miscellaneous supplies and expenses of the general offices, including the cost of all stationary, books, paper, stamps, pens, pencils, etc.; also cost of all printing of

blanks, circulars, statements, tickets, and the cost of advertising.

23. Insurance.—Includes cost of insurance on property of the company, and against injuries to employees, and all expenses of collection.

24. Legal Expenses.—In this account are included the salaries, fees and expenses of attorneys, witness fees and other court expenses.

25. Injuries and Damages.—Expenses on account of persons injured and property damaged, with payments of claims, are all chargeable to this account. Wages of persons while disabled, medical attendance and funeral expenses; also wages of claim agent and others connected with the claim department. Lawyers' fees and other court expenses are not chargeable to this account; nor are damages to property belonging to the company.

26. Contingent Expense.—This account includes the miscellaneous expenses not otherwise provided for; traveling and other expenses of general officers and assistants, etc., etc.

27. Park Properties.—Includes all running expenses of parks owned or leased by the company.

TRANSPORTATION EXPENSES.

28. Car Service.—This account includes the wages of conductors, motormen, starters, aids, inspectors and switchmen; cost of punches, ticket registers, sign sticks, switch sticks and miscellaneous supplies for car service. The wages of the superintendent of time tables and chief of conductors, with such clerks as may be under them, should also be charged to this account.

29. Car House Expense.—This account includes the wages of shed foremen, shifters, cleaners, oilers, wipers, laborers, inspectors and watchmen, except such as are employed on repairs of cars. The cost of fuel, and lighting the car houses and sheds, lanterns and oil for watchmen, tools used by workmen on cars.

30. Lubrication and Waste for Cars.—Oil, grease, tallow and other lubricants, with waste used upon car journals and motors, are included in this account.

31. Supplies.—This account includes such supplies as are constantly needed for the operation of the electric cars, but cannot be charged to repairs, such as lamps, fuses, carbon brushes, trolley cord, etc.

32. Wrecking.—Wages of those employed in getting derailed cars on the track, and removing obstructions and wrecks; tools used and all other expense incurred on the same account. Expense of getting cars back to the car-house, when broken down on the line, is also chargeable to this account.

33. Operation of Power-Houses.—This account includes wages of engineers, firemen, coal shovelers, dynamo men, oilers, cleaners and others employed in the power-houses, except when employed upon repairs. Also the cost of water, water rates, or cost of pumping where the company furnishes its own water works; carbon brushes, fuses, lamps and other supplies necessary for the daily operation of the power-houses, and not otherwise provided for; cost of heating and lighting power-houses. Repairs and renewals of engines, boilers, dynamos, switch-boards and station fixtures are not chargeable to this account. Fuel and lubricants are also chargeable to separate accounts.

34. Fuel.—This account includes the cost of all fuel used in the power-houses, with transportation charges on the same.

35. Lubricants and Waste for Power-Houses.—Oils, greases, tallow and waste for use in the power-houses, for engines, shafting, dynamos, pumps, etc.

36. Water.—Cost of water when taken from local water-works companies.

37. Hired Power.—Cost of power when taken from other electric companies.

MAINTENANCE OF WAY AND BUILDINGS.

38. Repairs of Roadway and Track.—This account includes all expenditures on account of the roadbed and track, except the cost of rails and ties used, and the cost of repairs and renewals of paving, and the supplementary wire. It includes tracks laid in buildings, yards, on turntables, wharves and over bridges; wages of road masters, track foremen, laborers, watchmen and others, while engaged in track repairs and renewals. It includes cleaning, oiling and sanding track, repairs and renewals of drains under the track, repairs and renewals of planking over bridges, repairs and renewals of frogs and switches, joint fastenings, etc., etc. It also includes repairs of rails, and all work on rails, cutting and drilling, except drilling for tie wires. Also labor expended in taking up track. The cost of tools, implements and all supplies used in connection with the track are included in this account, The expense of removing snow and ice, with the cost of repairs on snow plows and sweepers, may be made a separate account if so desired, but comes under the head of Maintenance of Way.

40. Renewals of Rails.—This account includes the cost of new rails laid in the track, with the transportation charges on the same, less the value of old rails taken up. The expense of loading, unloading, drilling, cutting, laying and repairing rails is not included in this account.

41. Renewals of Ties.—This account includes the cost of new ties laid in the track and the freight on the same. The expense of loading, unloading and laying ties is not included in this account.

42. Repairs and Renewals of Faving.—This account embraces all expenditures on account of the paving. It includes the cost of paving blocks and sand, and the cost of transportation of the same; the wages of pavers, laborers and others, engaged in repairs and renewals of paving; also the cost of tools and other supplies for the same work. The expense of taking up and relaying paving, when necessitated by the repairs on the roadbed, the track and the supplementary wire is not chargeable to this account, but to the account for which expense was incurred.

43. Repairs and Renewals of the Supplementary Wires.—This account includes all expenditures on account of the supplementary wire and its connections. It includes the cost of the wire, tie connections, channel pins, solder, and other supplies also tools, and implements used in connection with the work of repairing the supplementary wires; wages of solderers, laborers and others, engaged upon this work. The expense of drilling rails for channel pins and tie wire rivets, is also chargeable to this account. Expense on the supplementary wires, necessitated by the taking up of rails, ties, switches, frogs, etc., are not chargeable to this account, but to repairs of roadway and track. Expense on the supplementary wires necessitated by the taking up or laying of paving should be charged to the account of paving.

44. Repairs and Renewals of Buildings, Docks and Wharves.—This account includes the cost of repairs and renewals of all buildings, docks and wharves, and of the stationary fixtures and furniture of the same, not otherwise provided for; car-houses and sheds, storehouses, car-shops, repair-shops, blacksmith and machine-shops, power houses, coal sheds and bins, stations, etc., etc. Repairs of pits in car-houses and shops, cranes in power-houses and coal sheds, etc., are embraced in this account. Repairs of tracks in buildings and on wharves, are not chargeable to this account.

45. Repairs and Renewals of Poles and Overhead Lines.—The account includes the cost of repairs and renewals of poles and brackets, with trolley, span, guard and feed wires, with all appliances for suspension and insulation of the same.

MAINTENANCE OF EQUIPMENT.

46. Repair of Cars.— This account includes the cost of all repairs on car bodies, painting, varnishing, upholstering, re-lettering cars and car signs; repairs and renewals of the trucks, brakes, brake shoes, axle boxes, springs, track brushes, snow scrapers, pilots, sand boxes, etc.; repairs and renewals of wheels and axles. The cost of new cars taking the place of old to make the number good, are also chargeable to this account. On roads using both motor and tow cars it is sometimes advisable to keep each kind separately.

47. Repairs of Electrical Equipment.— This includes the repairs of motors, their parts and connections, the labor of removing damaged parts and replacing same when repaired. Armatures, fields, gears, pinions, controllers, switches, trolleys, lightning arresters, brush holders, cables, etc., all come under this head. New motors or parts purchased or made and put in to replace those damaged or worn out must be charged to this account also.

49. Repairs of Steam Plant.—To this account should be charged also repairs and renewals of the steam plant in the power-house, including the boilers, engines, pumps and shafting, repairs and renewals of belts, piping, steam fitting, etc.

50. Repairs of Electrical Plant.—Repairs and renewals of dynamos and their parts; armatures, fields, pulleys, commutators, oilers, bearings and boxes, brush holders, etc., are chargeable to this account; also labor removing and replacing damaged parts. Repairs and renewals of the switchboard equipment are also charged to this account, such as repairs and renewals of station switches, rheostats, circuit breakers, ammeters, wiring and connections.

51. Tools and Machinery.—Repairs and renewals of tools and machinery, shafting, boilers, engines, etc., in the shops of the company; also cost of lubricants for the same. Small tools (not shop fixtures) are chargeable to the account most benefited by them.

52. Miscellaneous Expense.—To this account should be charged all miscellaneous expense of maintenance and equipment, not otherwise provided for.

The Use of the Booster on Electric Railway Circuits.

Messrs. J. H. Vail and S. H. Wynkoop in a paper read at the Atlanta Convention on "The Use of the Booster on Electric Railway Circuits" advocate the use of Mr. W. S. Barstow's system of maintaining a constant voltage in a multiple electric circuit, consisting in the employment of an auxiliary apparatus called a "booster." They state that owing to the drop of potential on street railway lines the commercial efficiency of the street railway motor, which is normally about 78 per cent. becomes much reduced, at two-thirds normal being only 52 per cent. With direct feeding the loss in transmitting energy is overcome only by incurring the heavy cost of copper as a first investment. With the booster system, the loss in transmission is overcome by incurring the cost of operation of a machine which shall automatically raise the initial voltage above that of the bus bars by an amount which may exactly equal the drop in potential on the feeder at that instant. When using this machine, the feeder is calculated for ampere capacity only, and the pressure constantly maintained at the service end of the feeder equal to the pressure at the bus bars, irrespective of the length of the feeder or location of the load.

In any instance, the cost of a direct feeder increases as the square of the distance, while the cost of the booster feeder is stated to be directly proportional to the number of miles. The authors state that these characteristics of the latter system result in a reduction in first cost of from 25 to 75 per cent. as compared with the first cost of the ordinary direct feeding methods of present practice; and it thereby becomes possible for numerous electric street-railway companies to extend their lines into suburban localities from ten to twenty miles distant from the power station, at the same time retaining the investment within reasonable limits.

The following equations are given by the authors to enable the two systems to be compared:

Let:

C_1 = Current delivered to trolley wire.
V = Voltage at generator.
V_1 = Voltage at trolley wire.
V_2 = Voltage of booster.
f_1 = Efficiency of generating apparatus.
f_2 = Efficiency of booster.
K_1 = Operating expenses for direct feeding—coal, oil, water, waste, engineers, firemen, and interest on so much of the steam generating and transmission plant as is due to the feeder under consideration.
K_2 = Operating expenses for booster feeding—details as before.
L = Length of feeder in miles.
l = Circular mils of feeder.
A = Initial cost of as much of the steam, generating and transmission plant as is due to the feeder under consideration.
a = Per cent. interest on investment.
d = Per cent depreciation on investment.
S = Cost of steam plant per hp.
G = Cost of generating plant per kw.
B = Cost of booster per kw output.
W = Cost of insulated wire per lb.
R = Cost of placing 5,544 ft. No. 4-0 wire, including insulators, pins, cross-arms, sundry hardware and labor; 5 per cent. allowance for sag.
P = Cost of supplying one hp per year, in quantities of over 100 hp.

Then for direct feeding:

$$A = \frac{\frac{C_1 V_1}{746} + \frac{C_1 (V-V_1)}{746}}{f_1} S + \left\{ \frac{C_1 V_1}{1{,}000} + \frac{C_1 (V-V_1)}{1{,}000} \right\} G + \frac{2{,}315.488\ L^2 C_1}{V-V_1} W + \frac{.5664\ L^2 C_1}{V-V_1} R \qquad (1.)$$

And for booster feeding,

$$A = \frac{\frac{C_1 V_1}{746} + \frac{C_1 (V-V_1)}{746} + \frac{C_1 V_2}{746 f_2}}{f_1} S + \left\{ \frac{C_1 V_1}{1{,}000} + \frac{C_1 (V-V_1)}{1{,}000} + \frac{C_1 V_2}{1{,}000 f_2} \right\} G + \frac{C_1 V_2}{1{,}000} B + .019318\, l L W + \frac{l L}{211{,}600} R \qquad (2.)$$

Substituting the following values in (1),

$C_1 = 200$	$G = 25$
$V_1 = 500$	$W = 00.13$
$V = 550$	$R = 75$
$S = 45$	$B = 50$
$f_1 = 00.95$	

We have

$$A = 9{,}735 + 1{,}374\ L^2 \qquad (3.)$$

Substituting the same values in (2), assuming 211,600 as the value of l, taking $f_2 = .90$, and finding an expression for V_2 in terms of L, we get:

$$A = 8{,}723 + 2{,}857\ L \qquad (4.)$$

In order to graphically represent the relation between initial investments in the two methods of feeding under discussion, (1) and (2) have been solved for varying values of L from 1 to 30, and the results plotted on Fig. 1. An inspection on this diagram shows at once the superiority of the booster system over direct feeding in cases where first cost is the essential feature. It will be noted that the curves have been carried out for the entire thirty miles without regard to the practical voltage limit in direct-current machines, or the point at which the cost of operating an independent station becomes less than operating from the main station. Fig. 1 shows that for distances greater than one and one-half miles it will cost less to install a booster system than to place copper and machinery in the usual manner for feeding direct. In cases where the motive power is water, costing little or nothing per hp, these curves give at once the relative economy of the two methods; but ordinarily, on account of the consumption of coal, the loss in the line (represented in the new method by the power required to operate the booster) becomes an important factor in the discussion; and it is necssary to establish equations for the operating expenses, taking into account the fixed charges of interest and depreciation

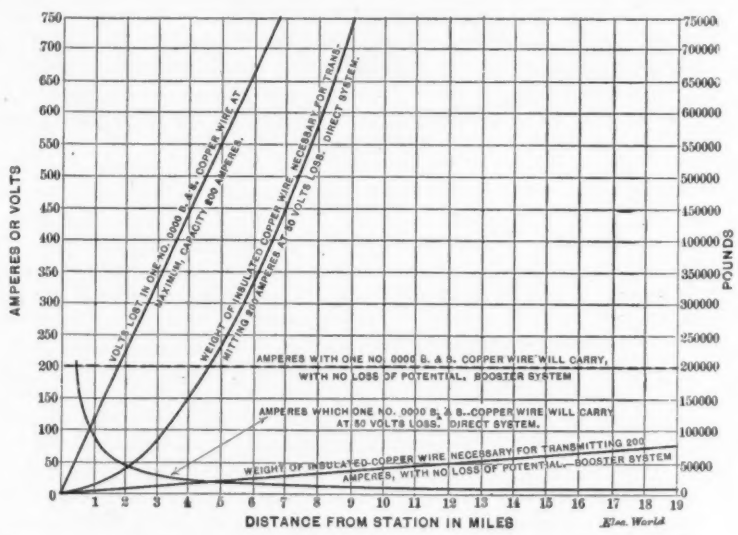

AMPERES OR VOLTS
POUNDS
VOLTS LOST IN ONE NO. 0000 B. & S. COPPER WIRE AT MAXIMUM CAPACITY 650 AMPERES.
WEIGHT OF INSULATED COPPER WIRE NECESSARY FOR TRANSMITTING 650 AMPERES AT 50 VOLTS LOSS. DIRECT SYSTEM.
AMPERES WITH ONE NO. 0000 B. & S. COPPER WIRE WILL CARRY, WITH NO LOSS OF POTENTIAL. BOOSTER SYSTEM
AMPERES WHICH ONE NO. 0000 B. & S. COPPER WIRE WILL CARRY AT 50 VOLTS LOSS. DIRECT SYSTEM.
WEIGHT OF INSULATED COPPER WIRE NECESSARY FOR TRANSMITTING 200 AMPERES, WITH NO LOSS OF POTENTIAL. BOOSTER SYSTEM
DISTANCE FROM STATION IN MILES
Elec. World

Fig. 3.—Comparison Between Direct and Booster Feeding for Street Railways.

on the investment, as well as the cost of furnishing the required power.

The following equations will enable these values to be determined for different distances:

Direct feeding:

$$K_1 = \frac{\frac{C_1 V_1}{746} + \frac{C_1 (V-V_1)}{746}}{f_1} P + A (a + d) \qquad (5.)$$

Booster feeding:

$$K_2 = \frac{\frac{C_1 V_1}{746} + \frac{C_1 (V-V_1)}{746} + \frac{C_1 V_2}{746 f_2}}{f_1} P + A (a + d) \qquad (6.)$$

Making the same substitutions in (5) and (6) as were made in (1) and (2), placing $(a + d) = .10$, and remembering that A varies according to the method and distance under discussion, we get:

$$K_1 = 155\ P + \frac{A}{10} \qquad (7.)$$

$$K_2 = (139 + 36\ L)\ P + \frac{A}{10} \qquad (8.)$$

Fig. 2 represents these equations plotted for varying values of L, P being taken at 40. The intersection of the upper curve with the upper straight line is the point at which the booster system costs as much to operate as does the direct system. This distance we find to be twelve and one-half miles. For shorter distances, direct feeding is more economical, while for longer distances the booster system has an absolute advantage. Now the assumption, upon which (5) and (6) were solved, is a feeder constantly loaded to its maximum capacity. The absurdity of this assumption is apparent when one

considers the actual conditions which obtain in railway work; the average load on the feeder during the entire year will be more nearly one-third or one-quarter of the maximum. Equations have, therefore, been established and plotted similar to (5) and (6), for three-quarters, one-half and one-quarter load, and the resultant curves are shown on Fig. 2, in order to afford ready means of comparison.

All calculations have been based upon the most recent methods of rail bonding and track feeding; and the assumption that the resistance of the return circuit is equal to that of the outgoing circuit is therefore perfectly safe.

While the method outlined may seem like robbing Peter to pay Paul, it must be remembered that in direct feeding there is a large amount of capital invested in the pole line, accruing interest day and night, and irrespective of the traffic on the line; while with booster feeding, the interest on copper investment is nominal, and the power required to drive the booster itself is proportional to the load on the line. Thus it can be understood why, under the conditions given, with an average load of one-quarter the maximum, the booster system is more economical than the direct feeding system for distances over four and one-half miles.

It may occur to some that the installation of a special high voltage generator to supply the feeder in question would be a simpler method of reducing the copper; but a consideration of the enormous variations in drop under extreme changes in load on a long feeder calculated for ampere capacity only, leads at once to the discarding

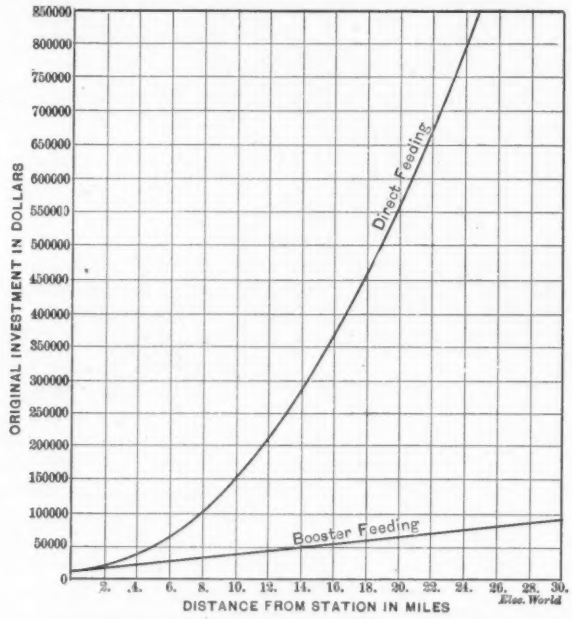


FIG. 1.—INITIAL COST OF STEAM AND GENERATING PLANT, COPPER AND SPECIAL APPARATUS FOR DELIVERING 200 AMPERES AT 500 VOLTS.

of such a scheme until such time as manufacturers can furnish efficient generators over compounded from 50 to 150 per cent.

Fig. 3 gives a specific comparison between direct and booster feeding, showing the investment saved in copper by the latter. The resistance of the return rail circuit is considered the same as the resistance of the feeder; the allowance for weight of insulation is .15 and for sag .05.

Ordinarily in calculating copper for distribution, special features influencing traffic are obliged to be allowed for, such as ball grounds, race tracks, picnic groves, etc. As there is seldom any necessity for bunching cars at all these points simultaneously, and as the various features are usually scattered, it follows that at all times one or more of the feeders is lying comparatively idle. Under the plan suggested, the copper is figured for average conditions, and a booster, placed in the station, is arranged to be thrown immediately upon any feeder which may become burdened with an excessive load.

Another feature of this system entailing economy becomes prominent on long suburban lines forced to run an infrequent schedule late at night. On such a road the booster may be shut down and cut out of circuit entirely when the load on the long distance feeder drops to say one-quarter of the maximum, depending upon the amount of copper in the line. If this suburban line extends to a park or pavilion which is open only during the summer months, the advantage of the booster over direct feeding is great, since the investment on a booster lying idle is a small fractional part of the interest on the idle copper of a direct feeder.

In the progress of electric railways, as in the growth of cities, development frequently fails to follow the lines predicted for it. It therefore happens that many a road to-day is worrying along, the victim of misplaced judgment—and copper. In many instances the adoption of a booster, and a re-distribution of the present copper, will remedy the evil in the most economical manner. In large cities such as Boston, Brooklyn and Philadelphia the purchase of tons of copper could in this way be obviated with a gain at the same time in uniformity of pressure.

Transfers on Street Railways.

Mr. J. N. Beckley in his report to the American Street Railway Association at Atlanta advocated the use of a liberal system of transfers. Such a system should not be too complicated by details or hedged in by narrow restrictions. A good system encourages travel and is a source of profit. The tickets should be of liberal size to permit legible type and prevent crowded matter and should be bound in pads of 100, the pad being so exactly arranged that the month, day and even the hour may be cancelled in ten tickets at once. The subject matter ingeniously arranged can and should comprehend all needed rules. A series number, conductor's number

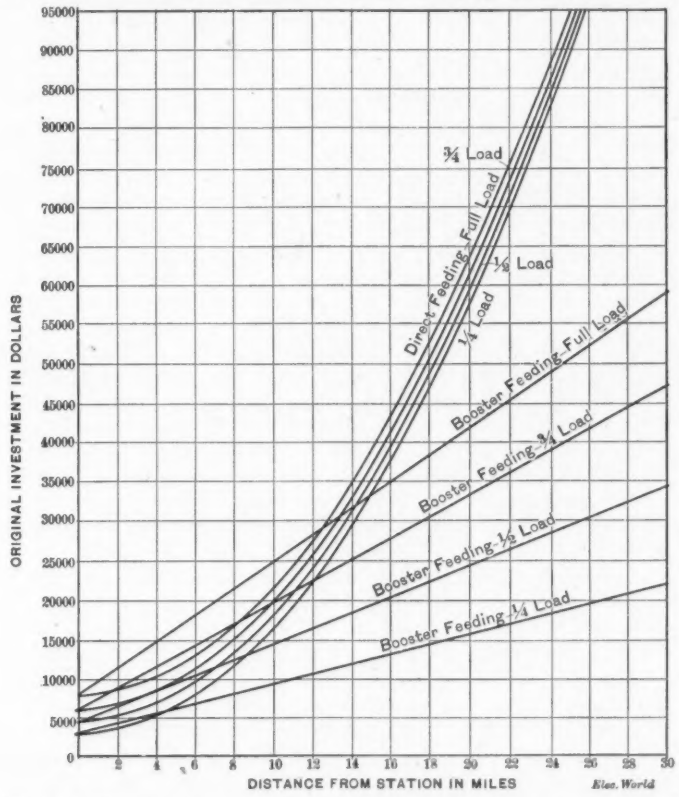


FIG. 2.—EXPENSES OF PLANT DELIVERING 200 AMPERES AT 500 VOLTS, INCLUDING COAL, OIL, WASTE, WATER, LABOR, INTEREST AND DEPRECIATION.

and run of car number, or some such designation of each ticket will identify the issuer perfectly. In the road with which Mr. Beckley is connected there are about 200 conductors; each is given a stack of 25,000 tickets, renewed as used, and these are kept in one transfer department provided with compartments for the purpose. The conductor turns in all unused transfers at the end of his day's work and they are put in his compartment and given out to him again the next day. One double page of a simple record book gives the transaction of each conductor for a whole year. Forenoon and afternoon are distinguished by light and dark print in the distinctions. By the system which this company uses one punch (always preliminary as the conductor keeps these punched ahead in readiness) cancels the month and day, another the time (even hour or ten-minute intervals) and a third the destination.

Reading matter should be arranged so that it can be read as punched all one way, being held by the thumb and finger of the left hand and punched with the left. The ticket should be arranged in every detail so as to be within the mental grasp of the average conductor and to make it easier to do right than wrong.

The consecutive number is not only useful in counting but compels the proper use of the tickets, for if one is used not in direct sequence the number at once tells who issued the ticket. Fraud on the part of the conductor is thus prevented.

Mail, Express and Freight Service on Street Railway Cars.

The report of the committee on this subject was presented at the recent meeting of the American Street Railway Association at Atlanta by Mr. Richard McCulloch. In order to ascertain how much had already been done in this line a circular was sent to every street railway company in North America. From some of the states, notably Pennsylvania, Rhode Island and Massachusetts, it was reported that transportation of express and freight by street railways was prohibited by state law, and many of the roads stated that their franchises allowed only the transportation of passengers.

In regard to the mail service it was found that 62 street railways are now carrying mail, 58 of which have United States Government contracts. Five roads operate special cars for this service.

The only method for handling a large mail service, where it is necessary to collect and distribute along the route, is an independent mail car in charge of a railway clerk. This system is already in use in St. Louis, Brooklyn and several other places. The best example for such service is that on the St. Louis and Suburban Railway. This road begins in the business part of the city and runs through the best residence, and suburban settlements of the town of Florissant, some 16 miles from the centre of the city. The mail car makes three trips each day, two to the end of the line and one as far as the city limits. The railway company furnishes a conductor and motorman while the post-office department supplies the mail clerks. The car is specially built for the purpose. The mail s received from the general post-office in pouches and delivered to arriers along the route, while mail which has come in too late to be sorted is distributed on the cars to the proper bags. In fact the service is practically the same as that on steam railways. A light freight business is also done on the car; provisions, light furniture, milk, trunks, etc., are carried and charges collected by the conductor. The car has proved a source of profit to the railway company.

Where the mere carriage of mail in pouches from the main office to branches or from depots to post-offices is undertaken, and no attempt is made at collection or distribution of mail along the route, there is no objection to carrying pouches on the front platform, if the number is not too great.

The question of whether or not mail service is called for depends entirely upon the local conditions. One of its advantages is that a fixed income can be assured, as the Government contracts generally pay a certain sum per 100 pounds per mile. Another advantage, and one which is of considerable importance, is the prestige of the name of the United States Government. The Government will tolerate no interference with the distribution of mails and this may prove a great advantage in the case of strikes and riots.

In regard to express and freight service 35 roads are now engaged in the express business, while 55 are hauling freight. The distinction, however, between the two classes of service is so ill defined that it is perhaps best to consider both together.

The street railway in many respects is an almost ideal agent for the transportation of packages and light freight, and such a service may well be looked into by street railway managers as a source of profit. As an example of such a road operating express and freight service involving collection and a house to house delivery, the case of the Southern Railway of St. Louis may be stated. The railway begins in the heart of the city and runs a distance of about seven miles through a thickly settled territory. Three trips per day are made on schedule time by the express car. At the down-town end is a receiving station where a clerk receives all the express parcels consigned to the company and keeps the books. The delivery is accomplished by means of wagons, two of which are kept at the down-town end of the road and three meet the cars at certain points along the line. A charge of ten cents per package is made for this delivery and trunks are taken from houses to the Union depot, checked and the checks returned for the sum of 50 cents. A corresponding charge, according to size, is made for the delivery of large boxes or bundles. The large dry goods and clothing houses have ceased to run delivery wagons into this part of the city and now consign all their parcels to the railway company. Several large factories also consign all their freight to these expresses. The railway company assumes all the responsibility of a common carrier.

It may even be advisable to establish an express or freight service as an auxiliary to the passenger traffic, regardless of whether it pays or not; the increased passenger receipts and the advertising given the company may more than counterbalance any loss.

As stated above, the use of a separate car is strongly advocated. A single box car equipped with motors of its own will handle the light freight or express of quite a territory, without interference with the regular running cars. A 25-foot car, equipped with double trucks, supplied with the most approved form of motors and controllers, and fitted up either as a mail car, express car, or a combination of both, may now be obtained for from $2,000 to $2,500, and a smaller car mounted on a single truck can be obtained for less money. If heavy freight is to be hauled it should be carried in trailer cars built especially for the purpose.

One interesting variation of such a service is that soon to be introduced upon the Union Depot Railroad of St. Louis, for which is now being built a hospital car. This is a 25-foot body double truck car, having a double floor filled with asbestos to deaden sound, and fitted with stretchers, apparatus for heating water by electricity, an emergency drug store, instruments and all necessary apparatus for caring for the sick and injured. A surgeon is to be in charge of the car.

The discussion of the whole question may be briefly summed up in the following conclusions:

1. That a mail service involving collection and distribution is best handled on a separate car, operated on the same plan as a United States Railway Mail Car. 2. That it is supposed that a great advantage arising from the transportation of the mails comes from the fact that the road is under the protection of the Government, and is thus secure from riots, strikes and blockades. 3. That the most promising opening for an express or freight service is a road running between two towns, of a city road running through well populated suburbs. 4. That the question whether or not such a service will pay is entirely a local question, and must be estimated for each road separately, under existing conditions. 5. That there are cases when it would be advisable to operate such a service, independent of the profits, in order to accommodate the patrons of the road and to induce building along the line or the road. 6. That such a service operated upon the ordinary street railway must not be allowed to interfere in the least with the passenger traffic. 7. That in States having laws prohibiting this service, associations of railway managers should be formed to secure favorable legislation.

Brake Shoes.

In a paper under the above caption read at the Atlanta Convention, Messrs. D. F. Henry and Powell Evans advocate the adoption of a standard brake shoe, and discuss the question of material for the same.

It is stated that in round numbers there are on all lines of street railways in the United States, 50,000 cars, including steam and eletric motors, cable grip cars, trail and horse cars. Assuming an average mileage of 75 miles per day for all cars, including an allowance made for cars used in rush hours only, and others under repair, the total result would be 3,750,000 car miles per day. Taking the average life of brake shoes at 5,000 car miles, and an average of 5 shoes per car, there is a daily consumption of 3,750 brake shoes, and an annual consumption of 1,368,750 shoes. At an average weight of 21 pounds each, new, the total weight is 28,743,750 pounds; at 2 cents per pound, amounting to $574,875. Deducting from these amounts an average weight, per shoe, of 9 pounds when worn out, there are 12,318,750 pounds of scrap, at 1-3 cent per pound, equal to $41,062, leaving a net balance of $533,813. This represents what is paid annually for metal actually ground to dust braking cars. To this must be added the cost of labor in changing the shoes. Allowing 30 minutes per shoe for replacement and adjustment of rods, etc., and $2 per ten hours' day for labor, this total annual charge would be $136,875. Adding this last figure to the net cost of metal, gives the total annual charge of $670,688 for brake shoes, equal to about $13.70 per average car.

The Master Car Builders' standard brake shoe is strongly advocated; it weighs less than any combined shoe and hanger, and most of the metal in it is available for actual wear—leaving the smallest possible percentage of residue for the scrap pile. This standard further requires but one pattern for right and left shoes for all trucks, and car-house men thus become more quickly familiar with it and accustomed to its fitting.

No conclusion is reached by the writers as to material. They state that there are three main conditions involved—that it should be economical in wear itself, economical as regards wear on wheels and should have a good co-efficient of friction. It seems to be generally conceded that neither chilled iron nor steel is advisable, as they have not a sufficiently firm hold on the wheels and wear them too much. Soft cast-iron, on the other hand, is satisfactory on both these points, but wears out too fast. Various combinations of soft and medium hard cast-iron, with wrought iron, chilled iron or wooden segments inserted in the frictional face—from 20 per cent. to 40 per cent. of the face—have given the best results in all these respects in street railway service so far.

City and Suburban Electric Railways.

The report on this subject, presented at the Atlanta meeting of the American Street Railway Association by Mr. E. C. Foster, considers the subject at some length. Mr. Foster expressed the view, in regard to the projection of a road, that it should at least be capable of earning its operating expenses from the start, and that there are very few cases in which companies are warranted in investing money in a line on the strength of the future alone. Competing lines should be avoided except where there is sufficient business to support both, or when it is necessary to keep out competition. In regard to track construction, the kind most desirable for a certain location depends entirely upon local conditions. It is now often possible to obtain an independent right of way for a very slight cost, sometimes for nothing, and this offers advantages over the use of the public highway. For such a right of way the regular steam road form of construction would be employed. About a 60-pound T-rail, 6x7 inch oak or chestnut ties, laid two feet centres, needle switches with lever throw, etc., would give a track that would allow a speed of 40 miles an hour, making it necessary only to lessen speed for curves and as much for switches as the overhead construction demanded. Where it is decided to build on country roads, a location at the side of the road is desirable. Here a T-rail may be laid and the track filled with gravel, covering the ties and leaving the heads of the rails entirely exposed. In the streets of small towns where permission can be obtained, it is also desirable to lay a T-rail, although there is always more or less trouble in maintaining the paved brow which is usually required. In city streets and others that are paved the girder rail seems to be the only one suitable. This should be nine inches deep and weigh about 90 pounds per yard. This makes a very expensive construction. While such a construction is necessary where the track is laid in streets paved from curb to curb, it is a question as to what is best in a macadam street The frequency of the service is an important factor in determining the most economical construction, and a nine-inch girder rail ceases to be a necessity when the number of cars run over it daily is reduced below a certain figure. Such a rail becomes covered with dirt and the cars rattle worse in running over it than in running on a dirty rail of less rigidity. It is worth while at least to consider for certain places the relaying of a good tram rail, using some approved form of joint plate.

In regard to overhead construction, little trouble is experienced in modern lines. Regarding equipment, the longest car that can be operated successfully on four wheels is the most desirable for ordinary conditions. For long distance lines having heavy traffic 30-foot car bodies on double trucks, for box cars, and bench open bodies on similar trucks, are recommended. Where there is sufficient demand a combination smoking and baggage car should be run as the trailer car on a train of two.

In building a new road for short distance travel, all curves should be given the necessary raidii for the use of 7-foot wheel bases, and trucks should be of this standard. On these trucks should be used 20-foot box car and 10-bench open cars, either class measuring about 29 feet 6 inches over the buffers. As a supplement to the regular cars, trailer cars are recommended, and that they may run economically a power-brake is necessary. To meet this demand an air-brake is being developed. For convenience in attaching motors to trailer cars automatic couplers are necessary, and there are several forms of latch couplings that work satisfactorily. For the use of trailers it is essential, of course, that all buffers and draw bars be of one height.

In regard to the electrical equipment, it goes without saying that the modern multipolar single reduction motors with series parallel controllers are the only ones that a road can afford to use.

It is desirable to heat all cars in the North as it has an important effect on the receipts. Electric heaters can hardly be depended upon. It is found from experience that it takes from 8 to 12 amperes to keep a 20-foot car comfortable; that is 40 degrees above the outside temperature. This would make 72 car miles of power per day of 18 hours chargeable against the heaters. When it is considered that this extra power is often demanded when the power is needed for other purposes, it may be seen that outside of the cost of coal the consideration of the increased capacity of the power station and feeder system is an important one. Unfortunately the stove is about the only thing to fall back upon, although for short trips from the car house a hot water storage system might be used.

It is probable that before long a telephone system will be considered a necessary part of each car operated on suburban lines. As a substitute for this arrangement, or in connection, with it a system of signals between turn-outs may be desirable, but this adds complications and is likely to encourage carelessness on the part of the men.

The adoption of a proper schedule of fares and transfers is a most important matter. Where the routes are too long for a single fare it is best to divide the line into sections, collecting a fare in each and registering all as the standard fares. The chief difficulty here will be in deciding the limits of the sections. The selections of the best rates of fare is an important subject and must depend upon local conditions. One and one-fourth cents per mile is perhaps a minimum rate for the basis of a system of fares, no fares to be less than five cents, and the establishment of higher rates up to two cents per mile may be recommended under certain conditions. In some cases it may be advisable to issue round trip tickets; transfers may be used within reasonable distances but the system should be carefully worked out to avoid the possibility of its abuse.

Suburban roads work at a disadvantage compared with city roads when the question of operating expenses is considered. In the city a much larger number of cars can be cared for in one car-house. A small car-house, also, cannot afford the motor tables, traveling cranes, etc., which lessen the cost of motor and truck repairs. The work can also be divided up in a large car-house so that the men can work with greater economy. The cost of power on suburban roads is often considerably higher, as they are usually dependent on a number of small stations. In regard to the elimination of the difference in power cost which now exists in favor of city roads, the indications are that the time is coming when by the introduction of the alternating current system it will be no longer necessary for the country road to maintain its numerous steam plants. In such a system there could be one main power station while in various selected places rotary transformers could be placed, one for each section of the road. These rotary transformers would require only the same care as generators, the only apparatus in the sub-station needing attention being the circuit breakers. The sub-station could often be in a car-house, thus reducing the cost of construction and labor. It is stated that with such a system using 6,000-volt three-phased currents from a station located in a central point, the power could be supplied by using No. O, B. & S. wire to a road 50 miles in length with 50 cars in operation, with a total efficiency, neglecting the loss in the trolley wires, of about 65 per cent. To accomplish the same result with the present system of 500 volts there would be required 600 No. O. B. & S. wires. Perhaps the most important difficulty of such a system would be the insulation of the line. The public is prejudiced against the use of bare wires and it might be wiser to cover the wires merely to save comment. It would be absolutely necessary to keep the wire off trees as the superintendent of the Hartford Electric Light Company states that a twig short circuits their 5,700 volt main almost as readily as a wire.

The Street Railways of Atlanta.

The following matter was inadvertently omitted from the article in our last issue under the above caption, and refers, except the last paragraph, to the Collins Park & Belt Railway:

The operating expenses average between $35 and $40 per day, and are divided as follows:

Motormen and conductors	$12.00
Superintendent and management	3.33
Other labor	12.33
Oil	1.00
Coal	7.00
Repairs	4.00

Motormen and conductors receive $1.50 per day, their average number of hours of work being 13. Trackmen and firemen get $1.00 per day each, armature winder $2.00 per day, car inspector $1.25 per day, chief engineer $2.25 per day, and night engineer $1.50 per day. The road does a good business in summer, but loses money in winter. At the present rate the road is earning about 6 per cent. on $50,000, or one-fifth of its cost. The road will continue to be operated by the receiver, Mr. Darr, until the times improve and the road can be sold.

The total investment in street railways in Atlanta is between four and a half and five million dollars. The three roads average very nearly 8,000 car miles per day and carry over 23,000 passengers daily.

Expensive Fishing.

An Englishman named Hill, has devised an elaborate, automatic, electric system for catching fish, the cost of the current for which is at least $2.62 per fish. He did not patent the system.

Notes on the Management of Railway Power Stations—IV.

BY GEORGE T. HANCHETT.

POWER CONNECTIONS.

The power connections of a station, like the steam fitting, so often have to be added to and repaired that a few notes on them will be considered.

The rule for the calculation of pulleys is well known, but is readily remembered if given as follows:

$$\overbrace{\text{Diameter} \times \text{speed}}^{\text{Pulley No. 1.}} = \overbrace{\text{diameter} \times \text{speed.}}^{\text{Pulley No. 2.}}$$

Thus, if we have three of the above quantities given we multiply

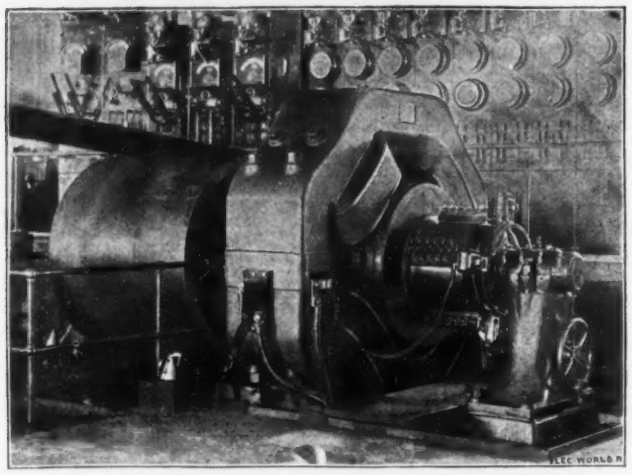


Fig. 13.—Belted Power House Generator.

together the two pertaining to any one pulley, and dividing by the remaining quantity we find the desired quantity, diameter or speed as the case may be. There is about 2 per cent. slip in good belt transmission, therefore, make the driver two per cent. larger than given by this rule, or the driven two per cent. smaller. The face of a pulley should be five per cent. wider than the belt it carries, and should be crowned .1 of an inch for every foot of width. The width of a belt is often computed solely from the tensile strength, the stress it has to bear, factors of safety, etc. This method is as fallacious as to figure the area of a wooden tension member by its tensile strength.

The width of belting should be governed by the adhesion to the pulley, the distance between centres and other data as well as the tension existing, and if all of these are carefully considered the resulting tension per inch of width will be as far below the tensile strength of the belt as the current of a carefully figured incandescent wire is below its carrying capacity. However, rules are given by competent authorities which depend on tension and not on adhesion. These are very convenient, and usually give safe values. The writer cannot see any proof for such formulae and would consider them as empirical rather than rational. The following are very good for general work:

$$\text{For single belts, } W = \frac{\text{hp} \times 3{,}000}{D \times R}$$

$$\text{For double belts, } W = \frac{\text{hp} \times 2{,}000}{D \times R}$$

where hp = horse-power transmitted.
W = width desired.
D = diameter of pulley in inches.
R = revolutions per minute.

This assumes that the belts are open, the arc of contact is a semi-circumference and that the pulleys are of equal diameter, and at least ten times their diameter between centres. If the case departs from this the width should be varied accordingly.

The formulæ given are modifications of existing formulæ. The writer on figuring a belt by the formulæ of four different authorities obtained results varying from 25 to 35.2 inches, and he ventures on his own authority to give the constants an average value, which will be found very convenient in figuring, and in his opinion sufficient for formulæ deduced on such principles, and upon which good authorities differ so widely. Such a general rule as this must be used very carefully. Cases where the belt costs $500 or more should be carefully specialized as money will be saved thereby.

In general, high speed belts need not be as wide as low speed belts transmitting the same pull. Double belts will not transmit twice as much power as single belts; their widths are in the ratio of about 2 to 3; they are strong enough to transmit twice the power but their area of contact is not proportional to their strength. General formulæ should be used on small belts *only*.

Belts should be tight enough to prevent slipping and flapping and *no tighter*. Belts that are too tight often absorb five to ten per cent. more of the energy transmitted than they should, beside being short lived. They shorten the lives of the bearings and greatly increase the chances of hot boxes. This is an evil which very often is prevalent in power stations. To avoid the necessity of tight belts never run with the tight side on top and never run belts at an angle from the horizontal greater than 45 degrees. Belts should be frequently softened with some reliable belt dressing. Never use a belt dressing that contains an animal oil. When you have carefully calculated and checked from reliable data the proper size of a large belt for a dynamo do not be afraid of your result. A small armature will absorb an immense amount of power. Fig. 13 shows a good example of such a case, where the armature seems very small in proportion to the pulley and yet the machine is in operation in a well designed station.

The running of a belt may sometimes be improved by changing it end for end. Never turn it inside out. Belt speeds of greater than 5,000 feet per minute are not advisable. The hair or grain side of the belt should run next the pulley. Never "run" a belt on to a pulley of a dynamo. Slacken off the tension screws and put it on and thus save straining one side of the belt. Short belts require to be tighter than long ones. The weight of a long belt materially increases its gripping power. Covering a pulley with leather permits a much slacker belt and saves power. It accomplishes the same result as perforating the belt, which is a most expensive way of getting better adhesion, and one of doubtful value. The adhesion is doubtless better, but the life and strength of the belt is seriously impaired.

It is said that there is a chemical action between the tannic acid of the belt and the iron of the pulley, which cuts the former. Leather covering would avoid this also. The static charges which accumulate on rapidly moving belts should be conducted away by combs made of sharp metal points and connected electrically with the engine bed. The shock from a static discharge of a belt, while never dangerous in itself, is extremely disagreeable and is liable to cause a man to lose his balance and fall in a dangerous place. The station engineer has enough chances of getting shocks without this added one.

For figuring the horse-power of a shaft the writer suggests the

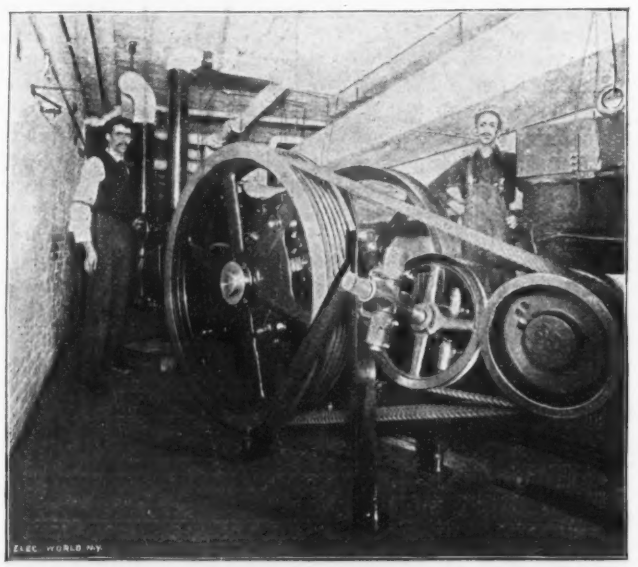


Fig. 14.—Example of Rope Transmission.

following formula, which will be found convenient, accurate and easy to remember:

$$\text{hp} = \frac{r^3 n}{16},$$

where r = the radius of the shaft, n = the number of revolutions per minute, hp = the horse power the shaft is capable of transmitting. This applies to turned iron shafting well supported by bearings, and is suited for jack shafts.

The following table, calculated from the above formula will prove

useful. To use it multiply the number in column B, by the speed of the shaft and obtain the horse-power it will transmit. It is easy to see that B is the horse-power transmitted at one revolution per minute.

Dia.	B.	Dia.	B.	Dia.	B.	Dia.	B.
1	.0078	2½	.1207	4	.5000	5⅛	1.299
1¼	.0192	2¾	.1625	4¼	.6437	5¾	1.485
1½	.0264	3	.2109	4½	.7119	6	1.687
1¾	.0419	3¼	.2937	4¾	.8376	6¼	1.907
2	.0625	3½	.3349	5	.9766	6½	2.145
2¼	.0889	3¾	.4119	5¼	1.131	6¾	2.402

Hot boxes on a jack shaft are more serious than on a single machine as they may disable the whole plant. It is well for this reason to have the jack shaft in sections. The boxes of shafting usually have compartments, which should be filled with heavy grease, that will melt if the box gets abnormally hot and thus lubricate it. A hot box on a jack shaft should be treated as explained in the last article, and, in addition, the load thrown off adjacent belts, if possible. If the shaft can stand the transverse strain without injury, withdraw the supporting screws from the hanger and allow the box to turn with the shaft. This is liable to "freeze" the box fast to the shaft, but it will save a shut down. It is usually necessary to push the box along the shaft to accomplish this.

Friction clutches when well made are very useful adjuncts. Their liberal use on the jack shaft will make the plant very flexible. A poor friction clutch is worse than none and will continually give trouble. In repairing or adjusting friction clutches be careful not to leave tools on the inside of the pulleys. On starting up they are usually thrown with considerable violence, or they may possibly remain in the pulley, and be thrown out at the end of the run. The writer witnessed a case where a monkey wrench had been traveling with the rim of a pulley for six or seven hours, and on shutting down his engine the engineer came uncomfortably near receiving the wrench on the head as it was hurled from the pulley.

In replacing a box on the jack shaft great care must be taken not to spring the shaft by the supporting screws. They should be screwed into their sockets by hand, and then set up alternately and finally locked. Newly babbited bearings or burned or scored bearings may be scraped to a surface by a half round file with all the teeth ground off, leaving only sharp edges. A mixture of stove blacking and cylinder oil may be rubbed on the shaft, and by occasionally applying the halves of the box to the shaft thus treated and scraping down the blackened portions, a smooth running surface may be rapidly attained. Babbited bearings can usually be repoured in place on the jack shaft. In such a case be careful to have the shaft free from oil or any foreign substance that would cause trouble by bubbles. Stop the ends and other places by frayed manilla rope strands well served with moist clay. The lower half should be poured first. This may be done from the side. Then the upper half may be bolted on and poured through the oil holes. Unbolt and separate the two halves of the box, and drill out the oil holes and cut off the snags. It may be necessary to flute some oil grooves. When scraped the box is then ready for use.

Direct connection is the ideal method to power connection. The obstacles of high speed of generators and low speed of massive engines have been so reduced that this is possible. It is more expensive than belt driving, but it is in every way more satisfactory. It economizes floor space, not, only by its small compass, but by the positions in which a set may be placed irrespective of other machines.

The rope transmission shown in Fig. 14 may often be used to great advantage. It, however, absorbs a great deal of power, and the pulleys get quite warm and the life of the rope is short. The chief attraction of the system is the economy of floor space.

In the case of Fig. 14 the engine speed is 320 revolutions per minute. The diameter of the drive pulley is 54″ the distance between centres 60″. The dynamo pulley has a diameter of 14″ and the idler is exceptionally large, being 18″ in diameter. The drive rope is ¾″. This is reputed to be the shortest rope transmission in the country.

The figure looks somewhat distorted, as it was a matter of extreme difficulty to photograph the drive. The lens was very wide angled, so much so that it was impossible for the operator to get out of its range. The camera stood in a little alcove not more than eight feet away.

Railway units are subjected to more severe changes of load than any other source of electric power. The whole system should be exceptionally rugged.

(To be continned.)

Electric Railways in Germany.

(From our own Correspondent.)

Great activity prevails in the preparation of projects for electric railways intended to furnish means of rapid transit throughout Berlin. The existing elevated road, which is worked by steam locomotives, traverses the town, roughly speaking, in a direction east to west, and joins at either end ring shaped loops which encircle the town north and south. The service of trains is frequent, but the running speed is very slow, so that fast running electric roads would be sure of patronage. Under these circumstances it is but natural that large electric manufacturing firms, as well as independent engineers, and even laymen, are busying themselves with the elaboration of railroad schemes, especially as it is hoped to reap a rich harvest in passenger fares when the exhibition, which is planned for 1896, will, it is thought, attract visitors to Berlin from all parts of the Fatherland. Some of the projects are yet in the air, others are so absurd that their realization is impossible, but some are good and will be carried out.

Amongst the latter is one for an elevated electric road from the Warsaw Bridge in the east of the town to the Zoölogical Gardens in the west. This line will run south of, and more or less parallel to, the central part of the existing belt railway, and will facilitate the communication with three of the most important termini of main lines running from Berlin to the south and east. The project has been worked out by Messrs. Siemens & Halske and has already received the sanction of the town authorities. The sanction of the Prussian State has not yet been obtained but is certain, so that active operations are about to begin.

Another electric road had been projected by the Allgemeine Elektricitats Gesellschaft, which was intended to pass through Berlin along a line approximately north and south. This road was to be carried in cast iron tunnels underground in the manner adopted for the City and South London and the Waterloo and City lines, but the town authorities have up to the present declined to give their sanction. It is, however, merely a question of time when this road will also be built, because the want of some means of rapid transit between the north and south of Berlin is very great and an elevated or a level road is inadmissible.

Even the tramway companies are beginning to realize the advantages of electric traction, as evidenced by the fact that the largest of these has for a fortnight had three electric cars running in between the regular horse cars on one of its lines. They are battery cars, supplied by the Allgemeine Elektricitats Gesellschaft, and the undertaking is merely intended as an experiment to show that electric traction, even with accumulators, is commercially feasible.

In addition to the lines just mentioned, Messrs. Siemens & Halske are now building two trolley lines, one in the north and the other in the south of Berlin, but without connection to the centre of the town. Another project which is almost certain to be carried out next year is the change of the present horse car line through the Thier-Garten into an electric trolley line.

In Cologne there has been erected a short experimental track of a suspended railway, the invention of Herr Eugen Lange. The road is formed by a continuous overhang at the side of iron posts, and the cars are suspended from this girder. The suspension is perfectly free, so that on curves the car assumes an inclined position. The inventor claims for this system great rapidity, cheapness, ability to pass sharp curves and an æsthetic appearance. Two members of the Berlin Magistracy have been sent to Cologne to inspect the experimental line and report on the question whether the system is suitable for Berlin.

Within the last few days yet another inventor has submitted to the municipality his plan for rapid transit. This gentleman, Mr. B. Grauel, proposes to lay throughout the town a kind of underground switchback, and aims at attaining on the deepest, and, therefore, horizontal portion of his track, a speed of 75 miles per hour. Passengers would have to change carriages between any two sections.

Ohm's Law.

One of the directors of an electric railway company inquired of one of the electrical engineers of the road the meaning of $C = \frac{E}{R}$, which he saw around so much, and on being told that it stood for Capital $= \frac{\text{Earnings}}{\text{Receipts}}$, he replied that he thought it was a capital joke.

Electrodynamic Machinery—XIII.

BY E. J. HOUSTON AND A. E. KENNELLY.

67. It is evident, since the attractive force exerted across a square centimetre of polar surface is equal to $\frac{\mathfrak{B}^2}{8\pi}$ dynes, that doubling the intensity at the polar surface will quadruple the attraction per square centimetre. Therefore, all electromagnets, which are intended to attract or support heavy weights, are designed to have as great a cross-sectional area of polar surface as possible, combined with a high magnetic intensity across these surfaces. If, however, the increase of the area of polar surface is attended by a corresponding diminution of flux density, the total attractive force across the surface will be diminished, because the intensity, per-unit-area, will be reduced in the ratio of the square of the intensity, while the pull will only increase directly with the surface. It is evident, therefore, that soft iron of low reluctivity is especially desirable in powerful electromagnets.

If, for example, cast iron instead of soft Norway iron was employed in the construction of the magnet of Fig. 48, and the same M. M. F., namely, 6,324 gilberts was applied the mean magnetizing force would be this M. M. F., divided by the mean length of the circuit in cms, or

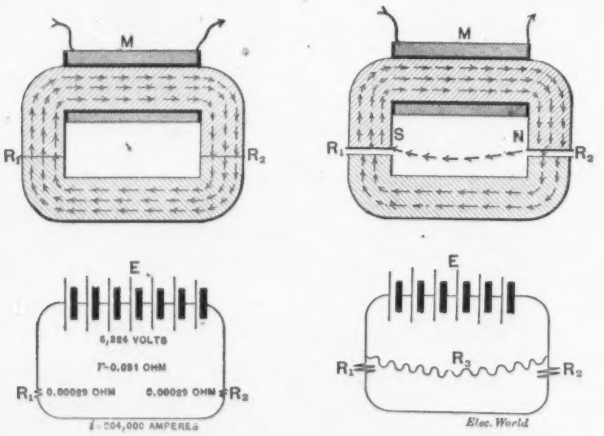
$$\mathfrak{H} = \frac{6{,}324}{50} = 126.48 \text{ gausses.}$$

At this magnetizing force a sample of cast iron would have a reluctivity represented by the formula $\nu = (a + b\mathfrak{H})$, where a, may be 0.0027, and b, 0.00009, so that its reluctivity at 133.92 gausses of magnetizing force would be $(0.0027 + 0.00009 \times 126.48) = 0.01407$. The reluctance of the cast iron circuit, including the small reluctance in the air gaps, would be $\frac{50}{12} \times 0.01407 = 0.05863$ oersted, and the flux in the circuit would be $\frac{6{,}374}{0.05863} = 108{,}700$ webers, or an intensity of 9,058 gausses. The magnetic attraction between the surfaces per square centimetre would, therefore, be

$$\frac{9{,}058 \times 9{,}058}{25.133} = 3{,}264{,}000 \text{ dynes, or } 3{,}331 \text{ grams weight,}$$

or 7.342 lbs. weight, and since the total polar surface amounts to 24 square centimeters, the total attractive force exerted between and across is 176.2 lbs. weight. The effect of introducing cast iron instead of wrought iron into the magnetic circuit, keeping the dimensions and M. M. F. the same, has been to reduce the tota pull from 620.64 lbs. to 176.2 lbs. or 71.6 per cent.

68. If now an air gap be placed in the circuit of half an inch (1.27cm) in width, at R_1, and R_2, as in Fig. 49, two results will follow:



FIGS. 48 AND 49.—DIAGRAMS REPRESENTING A SIMPLE FERRIC AND AN AERO FERRIC, CIRCUIT, AND THEIR ELECTRIC ANALOGUES.

(1.) A greater reluctance will be produced in the circuit.

(2.) A leakage or shunt path will now be formed through the air between the poles N and S. Strictly speaking, there will be some leakage in the preceding case of Fig. 48, but, with a ferric circuit of comparatively short length, it will have been so small as to be practically negligible. In Fig. 49, however, the reluctance of the main circuit between the poles including the air gaps will be so great as to give rise to a considerable difference of magnetic potential between the poles N and S, so that appreciable leakage will occur between these points. The reluctance of the leakage-paths through the air will usually be very complex, and difficult to compute, but, in simple geometrical cases, it may be approximately obtained without great difficulty. In this case we may proceed to determine the magnetic circuit first on the supposition that no leakage exists, and second on the supposition of the existence of a known amount of leakage. Assuming that the cores are of soft Norway iron, and that it is required to establish a total flux of 204,000 webers through the circuit, then the flux density in the iron will be 17 kilogausses and its reluctivity 0.0073. The reluctance of the circuit so far as it is composed of iron, will be 0.03042 oersted, while the reluctance of each air-gap will be $\frac{1.27}{12} \times 1 = 0.1058$ or, in all, 0.2016 oersted. The total reluctance of the circuit will, therefore, be 0.23202 oersted, and the M. M. F. required will be $204{,}000 \times 0.23202 = 47{,}330$ gilberts $= 37{,}660$ ampere-turns, or with 2,000 turns, 18.83 amperes. The attractive force on the armature will be 620 lbs. as in the previous case.

Considering now the effect of leakage, we may assume that the reluctance of the leakage path through the air $\mathfrak{R}_3$, is 0.5 oersted, and that a flux of 108 kilowebers has to be produced through the lower core; the length of mean path in the lower core being 20 cms, and in the upper core 30 cms, it is required to find the M. M. F., which will produce this flux through the lower core.

The intensity in the lower core will be $\frac{108{,}000}{12} = 9{,}000$ gausses, at which intensity the reluctivity of Norway iron will be, by Fig. 47, 0.0006, so that the reluctance of the lower core will be $\frac{20}{12} \times 0.0006 = 0.001$ oersted, and this added to the reluctance of the two air gaps, 1.27 cms in width, $= 0.2016 + 0.001 = 0.2026$ oersted. The magnetic difference of potential in this branch of the double circuit will, therefore, be $108{,}000 \times 0.2026 = 21{,}880$ gilberts. This will also be the difference of magnetic potential between the terminals of the leakage path $\mathfrak{R}_3$, and the leakage flux will, therefore, be $\frac{21{,}880}{0.5} = 43{,}760$ webers. The total flux in the main circuit through the upper core will be the sum of the flux in the two branches, or $108{,}000 + 43{,}760 = 151{,}760$ webers, making the intensity in the upper core $\frac{151{,}760}{12} = 12{,}647$ gausses, at which intensity the reluctivity is 0.00121, so that the reluctance of the upper core is $\frac{30}{12} \times 0.0012 = 0.003$ oersted. The drop of potential in the upper core will, therefore, be $151{,}760 \times 0.003 = 455$ gilberts, and the total difference of potential in the circuit, or the M. M. F., will be $21{,}880 + 455 = 22{,}335$ gilberts $= 17{,}775$ ampere-turns, or 8.89 amperes at 2,000 turns.

(To be continued).

Municipal Electric Lighting in London.

Hitherto the metropolis has been somewhat backward in adopting the latest thing in municipalization, to wit, electric lighting. Up to the present only one local authority, the St. Pancras Vestry, has undertaken the electric lighting of its own district. Recently, however, two more local authorities have brought themselves up to date. On Monday the electric lighting station belonging to the Hempstead Vestry was formally "inaugurated." This station is admirably situated in an open plot of ground close alongside the track of the London & North Western Railway, and close to its "compulsory area," that is to say, close to the district in which mains *have* to be laid under every street. This district is of triangular shape, and contains as fine a residential quarter as could be well imagined. The system of supply is of 2,000 volts alternating current, with transformers placed in pits under the pavements, with their secondaries feeding into a three-wire network. There are a few street arc lights. These are run off so-called constant potential 1,300 volt dynamos, the current being kept constant by varying the speed of the engine by hand, and by altering the resistance of the field magnet circuit. The other municipal stations which will be opened at once, is that at Ealing, a favored suburban district. Here also the system adopted is that of transformer-sub-stations; the only point of novelty being that the waste heat from the Parish refuse destructors "fume creator," from which gasses issue at a temperature of between 1,200 and 1,800 Fahr. is made use of to heat the boilers during the hours of light load, and the sewage effluent from the Parish sewage station, close at hand, is made use of for condensing purposes. All this sounds extremely economical, but whether, when everything is taken into consideration, any real economy will be effected, time alone will show.

Accidents to Fly Wheels in Power Houses.

To the Editor of The Electrical World:

Sir: In your issue of October 13th you publish a letter from T. C. Coykendall upon fly wheel accidents. This being a subject in which I am somewhat interested, I have kept a rough list of such accidents in the last two years, and find that there have been over thirty, causing a large total damage and a loss of several lives. I have given the matter no real study, but would like to present a few thoughts upon the subject to be considered with Mr. Coykendall's.

There are undoubtedly several causes of fly wheel accidents, the simplest being the case where the wheel goes to pieces from the running away of the engine, due to failure of the governor gear, from original defects or from accident. In the list which I have, I find only one or two accidents in any way chargeable to this cause, or in which there was even a noticable increase of velocity immediately before the accident. Other failures have been charged to "variation in load," but we find that fly wheel accidents are comparatively rare in rolling mills where the variations of load are fully as sudden and severe and always accompanied by much more shock or jar than is ever found in similar cases in electric service. There must evidently be some difference in the conditions, which difference I think will be found in the fact that nearly all the so-called "fly wheels" which have failed either in electric power or manufacturing service, have been used not only as "fly wheels" but as "transmission wheels," the power being taken off the rim by belts or gears.

Now, if we consider roughly the case of a fly wheel acting purely as a fly wheel, with all the power taken off the shaft at some other point, it will be found that when in service the arms of these wheels, when the engine is running under its normal load, will be subjected only to the strain necessary to carry round the rim, with the slight additional work required to pass the engine over the centres. A sudden releasing of load from the engine will tend to let the engine go ahead with the result that the arms have to take the additional strain of holding back the engine to the rim, which continues at practically the same speed. This strain will be in the same direction as the former general strain upon the arms, and will be immediately lessened by the cutting off of the steam by the governor. In the case of a sudden increase of load, the tendency of the wheel will be to go ahead in order to pull the shaft around to meet the increased load, and the admission of the steam by the governor will tend to thrust the engine forward, thus relieving the arms of a large portion of the work thrown upon them by the rim.

Take, now, the case of the fly wheel acting as a transmission wheel with the power taken off at the rim. With the engine running under its normal conditions, the pull upon the rim tends to keep the wheel back, and the tendency is for the steam, through the medium of the piston, connecting rod, crank and shaft, to tear the arms out of the wheel forward. A sudden release of load means that the rim of the wheel is immediately allowed to go forward, thus lessening this tendency, and at the same time the cutting off of the steam by the governor lessens this tendency still more by the slowing down of the shaft.

Take, however, the same engine running light, and suddenly increase the load, we find that the strain upon the arms tending to tear them out forwards is immediately enormously increased by the extra force tending to hold back the rim, while at the same moment the governor, opening to give steam to the engine, gives additional tendency to tear out the arms forward, only limited by the amount of possible total pressure on the area of the piston, with full boiler pressure, and the momentum of piston, connecting rod, etc.

These conditions, it seems to me, would fully account for nearly all these large wheels going under sudden increases of load rather than sudden decreases of load, and would show that either we should abandon the taking off of the power from the rim of the wheel or completely re-design wheels to meet the new conditions. It is particularly interesting to note that in nearly every one of these cases the wheels have been large in diameter and the speed of the engine slow or moderate. I have not on record a single case of a really high speed engine breaking either a fly wheel or transmission wheel. This I think is due to the fact that such engines always have wheels of small diameters traveling at high speeds, and the small diameter reduces the leverage upon the arms so as to bring them well within safe limits, for these particular strains when made large enough to take care of the ordinary ones.

Throwing on a sudden load, greater than the maximum for which it is designed, certainly should not wreck an engine, and I would point out that it does not seem to have been a matter of so much difficulty to design engines that will stand such a load. I have repeatedly seen engines developing over 300-hp, and running as high as 250 revolutions per minute, brought to a standstill in three or four seconds by a dead short-circuit on generators, and in many stations it is the regular practice (and in fact is a necessity) to throw the whole load off and on engines as quickly as switches can be thrown, and in such cases accidents are comparatively unknown. In rolling mills also it is a common occurrence to have an engine "stalled" by overload. In our business it is a regular practice when starting a new engine to throw the whole load off and on several times in quick succession just to be sure that the governor is working freely, and we are always glad when the engine is on electric service, since this affords such an easy and quick way of changing load. The question then is—is not the supposed safety of the slow speed engine largely a myth, and does not the question of immunity from accident lie in the use of small and heavy wheels at high speed rather than comparatively light and large wheels at slow speed?

Philadelphia, Pa. T. CARPENTER SMITH.

To the Editor of The Electrical World:

Sir: Since, from whatever cause, fly-wheel accidents do occur in electric power plants, resulting in almost complete destruction of equipment and building, it is but natural to look for some device or arrangement by means of which these disastrous results may be practically averted. Most engineers have given the matter considerable thought, knowing as they do the severe conditions of service, the numerous possibilities of defective fly-wheel castings, and faulty alignment of spokes and rim, placing the entire strain on only a part of the spokes and bolts entering into the built-up structure.

It is generally conceded that accident result from abnormal speeds, either coming from excessive steam admission due to a faulty governor, or by reversal of polarity in the generator such that it receives current as a motor, thus speeding up the engine independent of vacuum or steam supply.

As possibly one means of insuring against disasters of that kind, I would suggest the following: In addition to what is now used, place on the main shaft to the engine a centrifugal governor without belting or gearing, the weights of which revolve in a vertical plane around the shaft. When an excess of speed comes which the regular governor fails to check, the shaft governor would act instantaneously in throwing an electrical switch, which would shunt from the bus-bars of the station a current through an electro-magnet, this magnet automatically unhooking the valve gear or closing an additional throttle valve. At the same time the same current would pass through the coils of another magnet having its armatures attached to a switch on one of the leads from the generator which would automatically break the generator circuit, thus insuring against dangers, both from engine and generator.

The governor could be placed on the hub of the fly-wheel, being of the general form of those used in automatic engines. The magnets could be wound with heavy wire and large currents shunted into them, thus insuring great strength and promptness of action.

The apparatus would be exceedingly simple in construction and cheaply made; no trumped up "home made" arrangement, however, would do. The governor should be sensitive and of first-class workmanship and quality, because success would depend on its direct satisfactory action.

New York, N. Y. GEORGE H. DAVIS.

To the Editor of The Electrical World:

Sir: I have noted with interest the article on fly wheel accidents by Mr. Coykendall, in your issue of October 13.

The problem seems to be largely, if not wholly, one of inertia. In the case of the accident cited, I believe the fly wheel was used also as a band wheel (driving a belt). When the heavy short circuit was thrown on to the generator there was an enormous force instantaneously applied to the fly wheel, at the rim, tending to stop the rotation, but the momentum of the heavy spokes and rim resisted stoppage with such force as to rupture both rim and spokes Oftener in such cases the belt breaks. If the above wheel had been used simply as a fly wheel the accident might not have occured, as the force tending to stop the wheel would have been applied from the center and the strongest tendency would have been to shear the spokes from the hub, where there is usually ample material to resist such strains

Chicago, Ill. S. S. HOWELL.

To the Editor of The Electrical World:

Sir: I am greatly interested in the letters on fly-wheel accidents that have appeared in the columns of The Electrical World, and am sorry that all the writers seem to find fault with the Corliss engine.

Now, I have never seen a Corliss engine which would make more than two revolutions before the governor would have control, even if the full load was thrown off instantly. For by the time the engine had made two revolutions, the governor would have lifted so high that the steam valves would not open.

Prof. R. H. Thurston in his letter says "if the key should drop out of the governor pulley or the belt break, the engine is gone." Well, if an engineer had charge of the plant he would have the safety ring on the governor in its proper place, and the rest of his valve gear in order, and then when such a thing happened the engine would stop.

In my opinion the men who are put in charge over the engineers' department where these accidents occur are the ones to blame; for nine times out of ten they are responsible for the conditions that lead to accidents or employ men who do not understand their business. If the managers of some of our large electrical plants would dispense with the service of some of their so-called electricians, and pay fair wages to a competent engineer, they would have no reason to find fault with the governor or any other part of the Corliss engine.

GEO. E. O'NEILL.

Brooklyn, N. Y.

Symbols and Abbreviations.

To the Editor of The Electrical World:

Sir:—I have read the article in the London *Electrical Review* which contains Prof. Jamieson's criticisms of the system of all symbols and abbreviations recommended by the Chicago Congress, and I wish to make some observations in reply.

He objects to the French script letters, and would use instead block or Clarendon letters, because the latter are more common and more easily made. But this proposal violates one of the fundamental principles of the Congress system, namely, to use script or oblique letters as symbols for quantities and perpendicular letters for the names of units or their abbreviations. Block letters such as **M**, **H**, **B** are very suitable for representing general units, that is, units independent of any particular set of fundamental units; for example, **L** for any unit of length, **T** for any unit of time; **L : T** for the general unit of velocity. For purposes of instruction this use of block letters is very convenient, and, I believe, was first made in a volume of mine on *physical arithmatic*. By Clarendon letters I understand black letters, hooked at the ends and corners, as **L**, **T**; they were introduced into analysis by Heaviside for the purpose of denoting vector quantities. Would it be right to seize and appropriate for a different purpose, the type which the vector analyst has preempted, and which is required in the higher investigations of electrical science?

Prof. Jamieson is not satisfied with the length of the names ohm, dyne and erg, but would use ω, δ, ε, for short. But ω, δ, ε, are not abbreviation formed after the principle of the Hospitalier system; they are rather arbitrary marks. Besides, it is a principle of that system that Greek letters should be reserved for symbols, and the Frankfort Congress recommended a further restriction, namely, to denoting angles and physical constants.

As the sign for "per" he prefers the solidus to the colon, and gives as reason "A line, so /, always signifies *per* or ÷ *by* in mathematics." This is not quite exact, and in a critic of the Congress system we expect the utmost precision. The sign / signifies *per* or *divided by*, and is equivalent to :. In the names for units it is the hyphen, not ×, which is used to denote the product connection; consequently where the quotient connection is to be expressed in a name, a sign other than the algebraic sign of division may be preferable. But, be that as it may, it is certain that the colon is the more ancient sign, and also that some of the innovations which have been introduced in connection with the solidus are far from being unobjectionable. The use of the solidus is subject to an ambiguity which has never been settled by a distinct convention. With some writers $a + b \,/\, c + d$, is used to mean $\frac{a+b}{c+d}$, with others to mean $a + \frac{b}{c} + d$. The latter, though not the usual, is doubtless the correct meaning; to express the former brackets are required, thus $(a + b) \,/\, (c + d)$. Why are the brackets unnecessary in the usual notation? Because the horizontal bar serves as a vinculum as well as the sign of division. Thus the linear plan of writing algebraic expressions labors under the disadvantage of requiring a more extensive use of brackets. Also, it is not so synoptic, for the field of exact vision taken in by the eyes at a glance is not a strip, but a circle. By its inventor, Stokes, the solidus was intended merely as a means of printing an algebraic expression linearly when it occurred in the middle of the text.

Prof. Jamieson objects to v, g, and mho as unnecessary, and prefers the reciprocal expressions $\frac{1}{u}$, $\frac{1}{R}$, and $\frac{1}{\omega}$. Were he logical he would write these $/\,u$, $/\,R$, $/\,\omega$. But it is not a new idea to express the reciprocal of a unit in the same manner as the reciprocal of a symbol. Any one, not a Gael, finds a difficulty in pronouncing *mho*, but how are we to pronounce $\frac{1}{\omega}$? Only by means of a many syllabled phrase.

He thinks ML^2 sufficiently concise for moment of inertia, and ml quite good enough for magnetic moment. Electricians, on the contrary, will hold that each of these quantities is of sufficient importance to demand a special symbol for itself. For electric power he considers that W_P is better than P, because the former signifies power in watts. But it is a principle of the Congress system that P as a symbol does not refer to any unit, and as a numerical value it may be used with reference to any unit of power, whether watt, or kilogrammetre per second. Besides W is the symbol chosen to denote work. For current he prefers c to i, because "intensity" has no meaning in the phrase "intensity of current." This objection was before the Committee of Congress, and as it is a matter not of error, but of preference, it is surely binding on electricians to accept their decision.

Thus it will be seen that the proposed modifications of Prof. Jamieson are based on personal preference, or on a failure to grasp or, at least, to respect, the fundamental principles of the recommended system. Their tendency would be to change a logical system of notation into a miscellaneous jumble of shorthand.

Ithaca, N. Y. ALEXANDER MACFARLANE.

A Question of Thermodynamics.

To the Editor of The Electrical World:

Sir:—On page 359, October 13th issue of The Electrical World, is a mistake which is seriously misleading to those not familiar with thermodynamics.

Assuming the constant 0.058 to be true, then $(331° - 80°) \times 104 \times 0.058 = 1{,}514$ nearly, and the equation $\frac{1{,}514 \times 778}{33{,}000} = 35.7$ hp is true, but the statement that 27½ per cent. of the available mechanical energy is lost through this amount of radiation is wrong. It is true there is a loss of energy that would be delivered at the fly wheel of the engine if the pipe were thoroughly covered to prevent radiation.

The extreme theoretical range of temperature in a non-condensing engine working under 90 pounds pressure, is 331° — 212° = 119°, representing only 36.3 available heat units to be converted into mechanical energy from each pound of steam, which is but a trifle over 3 per cent. of the energy existing in the steam in the form of heat, considering water at 32° the basis.

Now, a conversion of a trifle more than 0.04 pound of steam of 90 pounds pressure into water of corresponding temperature, will give out as much energy in the form of heat as is received in the form of mechanical energy from one pound of steam expanding from 90 pounds pressure down to atmospheric pressure.

The loss of 35.7 hp by radiation, in the pipe in question, can be fully accounted for by the presence of but little more than 4 per cent. moisture at the engine. And a test will show, that instead of materially lowering the temperature of the whole body of steam as implied, the loss will be made manifest by the presence of moisture, and the actual loss will fall from 27½ per cent., as stated, to perhaps less than 5 per cent.

Fredonia, Ill. FRED W. RICHART.

To the Editor of The Electrical World:

Sir:—The criticism of Mr. Richart's is just. The temperature given corresponded to saturated steam and in that case his remarks are correct.

While making the statement I had in mind the case of superheated steam in which the heat of the superheat is the first to go and is practically foot-pounds at the engine. A more careful revision of the statement would have corrected this error. If a good fireman and a well designed boiler are so fortunate as to supply superheated steam, the advantage should not be lost by unclothed steam pipes.

Providence, R. I. GEORGE T. HANCHETT.

DIGEST OF CURRENT TECHNICAL ELECTRICAL LITERATURE

COMPILED FROM PRINCIPAL FOREIGN ELECTRICAL JOURNALS

BY CARL HERING

ELECTRO-PHYSICS.

Action of Alternating Currents on Dielectrics.—Continuing the discussion on this subject Mr. Addenbrooke, in a communication to the Lond. "Elec. Rev.," Oct. 5, quotes from Geipel & Kilgour's pocket-book a table giving the results obtained by Siemens Bros. & Russell, for the sparking distance in inches between planes, from which he deduces the fact that the sparking distance in air for alternating currents, is, under the same circumstances, equal to about the square root of two times that of continuous currents, or nearly half as great again; the statement that the sparking distance in air for alternating currents was practically equal to that of a continuous current of the maximum pressure of the alternating, is therefore correct. Good comparative tests are wanting, however, to show whether their relative sparking distances are maintained in solid or liquid dielectrics Siemens Bros. found that the sparking distance for rubber covered cables was about one-third that of air; Prof. Hughes showed that some resinous oils have a dielectric strength from 50 to 80 times that of air. A film of 1-250th of an inch will withstand a pressure of 10,000 volts. As mechanical conditions require at least 1-10th of an inch of insulation, the dielectric strength of materials and cables for 2,000 volts for instance, is enormously in excess of the sparking distance. In air it would be 1-35th of an inch, therefore in rubber about 1-175th, and in good resinous oils about 1-10th of this. The sparking distance across an exposed surface, however, may be three times this distance, and it is across such surfaces, the insulating qualities of which have been deteriorated by electrolytic or atmospheric influences, that breakdowns occur, but whether there is a greater tendency for such action with alternating than with continuous currents, is still undecided, and he agrees with Prof. Thompson that, taking all things into consideration, the difference in practice may be considered negligible. He gives the opinion of a superintendent at the Callender works, who states that as far as he knows there is no difference; he concludes that there is in this direction no commercial reason for considering alternating currents inferior to continuous.

Dielectrics.—A Physical Society paper, by Mr. Appleyard, is published in the "Phil. Mag." for October. He states that electrification seems to be the net result of many simultaneous actions, some of which are very obscure, and there is no theory to adequately account for the phenomena. The paper presents some of the difficulties encountered in an attempt at a solution, in the form of experimental results. Among other things he finds that a celluloid sheet pressed between two metallic surfaces has a negative electrification, but when between mercury surfaces there is no electrification. He discusses dielectric hysteresis, residual charge, experiments with gutta-percha, and a sensitive dielectric made of a mixture of brass and gutta-percha. In the latter he finds there is a critical point in the proportions, above which it has a very high resistance and below which it has a very low resistance. This proportion seems to be two parts by weight of brass and one part of gutta-percha.

Velocity of Cathode Rays.—A paper by Prof. J. J. Thomson, published in the "Phil. Mag." for October, is abstracted in the Lond. "Elec.," Oct. 5. He describes experiments made to determine the velocity, as a knowledge of this enables one to discriminate between the two views as to the nature of cathode rays. He finds that the velocity is about 1-9 multiplied by ten to the seventh power in centimeters per second. This is small compared with the velocity of the main discharge from the positive to the negative electrode. The velocity is about 100 times as great as the velocity of the mean square of the molecules of hydrogen at zero degrees C.

Velocity of Ions.—A paper by Mr. Whetham, on the velocity of ions and the relative ionsiation-power of solvents, is contained in the "Phil. Mag." for October. He shows by experiment that the velocity of the ions is reduced in about the same proportion as the conductivity, and that in the case under consideration the conductivity can be calculated from a knowledge of the opposite ionic velocities. His experiments suggest that the specific inductive capacity and the viscosity are the chief factors in determining the relative ionisation power of a solvent.

Movement of Pure Ether.—A mathematical article by von Helmholtz, from "Wied. Ann.," vol. 53, p. 135, on the consequences of the theory of Maxwell regarding the movement of pure ether, is published in "L'Eclairage Elec.," Sept. 29.

Propagation of Electric and Magnetic Perturbations.—Mr. Blondin's mathematical article is continued in "L'Eclairage Elec.," Sept. 29.

Electron or Atom of Electricity.—In a communication to the "Phil. Mag." for October, Dr. Stoney claims that he, and not Helmholtz, was the first to call attention in 1874 to a unit or atom of electricity which he called an "electron," and which he found was equal to 10 to the minus 20th power part of a coulomb, or 3 multiplied by 10 to the minus 11th power of the electrostatic unit of quantity. A more recent estimate of Prof. Richarz is 12.9 in place of 3 in the last named value.

Unipolar Induction.—A paper, by Dr. Lecher, from the "Wiener Berichte," July 12, is very briefly abstracted in the "Phil. Mag." for October. It contains historical and general observations, showing that neither previous experiments nor more recent modifications can settle this question. He describes the following crucial experiment: "A magnet is divided by an equatorial section in two parts, each of which can rotate separately. By means of suitable spring contacts it is possible to obtain from the two ends of the magnet an induction current which cannot possibly be due to a cutting of the rotating lines of force in the short fixed spring contacts. The current is easily explained if we adopt the view of Farady which, however, he afterward abandoned, that the rotating magnet cuts its own fixed lines of force, and thus has an electromotive action."

Origin of Earth Currents. A paper by Prof. Bachmetjew, of Sophia, is begun in the "Zeit. Feur Elek.," Oct. 1. Nothing of importance is given in the first section other than a brief resume of papers published.

MAGNETISM.

Steel vs. Iron.—An editorial in the Lond. "Elec. Eng.," Oct. 5, calls attention to a new and peculiar form of cast steel intended for a dynamo, recently tested by Mr. Kapp and Prof. Ewing, and which is said to have given excellent results, chiefly in giving a high permeability at strong magnetizations, it being considerably higher than that of good wrought iron. According to Prof. Ewing, the permeability at low magnetic forces is less than that of wrought iron, but the reverse is the case with high forces. From $\mathfrak{B} = 14{,}000$ upward its permeability is superior to that of iron forgings, and there will consequently be more magnetism for given exciting current. For $\mathfrak{H} = 40$, $\mathfrak{B} = 17{,}000$, as against 15,000 to 16,000 in wrought iron, while an induction of 18,000 may be reached with a magnetising force of 68, whereas ordinary wrought iron would require 125 for the same induction. The hysteresis loss is also better. It can be made remarkably free from blow-holes, and excellent surfaces can be obtained for the castings. The Lond. "Elec." also calls attention to this subject, and mentions the firm of Edgar Allen & Co., as makers of a material, whether steel or iron, is not stated, on which Prof. Ewing made some reports (whether this is the same as the steel above referred to is not stated, but it is not unlikely that it is).

Circular Magnetization of Iron Wires.—A paper by Prof. Klemencic, from the "Wiener Berichte," July 5, is abstracted very briefly in the "Phil. Mag." for October. He finds that the susceptibility of soft annealed iron around the axis is less than in the direction of the axis, and the residual magnetism has greater values with circular than with axial magnetization.

Magnetism of Hollow Cylinders.—Mr. Kalischer replies in the "Elek. Zeit.," Oct. 4, to the recent article of Mr. Grotrian abstracted in the Digest Sept. 15, stating that the experiments which that writer described were largely made and described by Faraday. An abstract from Faraday's works is given in full, and it is stated that he suggests a complete analogy with the inner space of a metallic vessel charged with electricity.

Magnetic Properties of Asbestos.—Mr. Swinton, in a communication to the Lond. "Elec. Rev.," Oct. 5, cites some recent experiments showing that with a strong electromagnet a piece of white asbestos board, weighing about half an ounce, was easily lifted through a vertical distance of 1.5 inches, and that in contact with a manget it would support four ounces additional weight; also that it is easy to magnetise it permanently. He thinks it is due to the oxide of iron which is contained as an impurity, but adds that the degree to which it is magnetised seems surprising. Asbestos should, therefore, not be used in delicate instruments, where a permanent magnet introduces an error.

Magnetic Constants of Soft Iron.—Some errors were contained in a table published in the article by Dr. Froelich, and mentioned in the Digest Oct. 13. The "Elek. Zeit.," Oct. 4, publishes a corrected table.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Board of Trade Laboratory.—A well illustrated description of the standard ampere balance, showing its construction, is published in the Lond. "Elec.," Oct. 5. It consists of a coil suspended from the arm of an accurate balance, and situated between two fixed coils. The descrip-

tion is quite complete, including the dimensions and data of the coils. A description of the volt standard is promised. The Lond. "Elec. Eng.," in continuing its article on this laboratory, also gives a description of this ampere standard, including illustrations of some further details. It also describes at some detail, and with illustrations, the 100-volt standard voltmeter, made somewhat on the principle of Sir Wm. Thomson's quadrant electrometer with ten parallel vanes. Some other instruments are also described and illustrated. The article mentioned in the Digest Sept. 29, is continued in the Lond. "Elec. Rev.," Oct. 5. The present section is devoted to a description of the several rooms in the Board of Trade Laboratory at Whitehall. An illustration of the Standards Laboratory and one of the Verification Room, is given.

Electrical Standards.—The final reportof the British Committee is published in the Lond. "Elec. Eng.," Oct. 5. It refers to the specifications for the preparation of the Clark cell.

Construction of Resistances.—Mr. Morris' paper is concluded in the London "Electrician," Oct. 5. He discusses carbon plate rheostats, liquid resistances, and step-by-step resistances. In giving the formula for the heating, he gives the rough and ready rule that with a permissible rise of temperature of 60 degrees C, the watts which can be absorbed per meter are equal to 20 times the diameter in centimeters, or 50 times the diameter in inches. It does not depend on the material. It corresponds to about one watt per 16 square centimeters of surface. Dr. Fleming found that with rods of plumbago and plaster of Paris, it was possible to dissipate one watt with six sq. cms. of surface. He gives illustrations from the paper of Mr. Dettmar (see Digest Jan. 6, under "Kruppin"), showing the spacing of the convolutions of spiral resistance for most rapid cooling, absorbing maximum watts per meter of wire (the data here given appears to be either insufficient or not quite clear). He also gives an illustration of a manganese wire resistance designed by Dr. Fleming for dissipating 3-hp.

Galvanometer.—A new Ayrton-Mather galvanometer of the d'Arsonval type, for test room work, is illustrated in the Lond. "Elec.," Oct. 5. A somewhat fuller description is given in the Lond. "Elec. Eng.," Oct. 5.

Thomson Bridge.—An illustrated description of a bridge for measuring the resistance of large bars, together with a complete diagram of the connections, is published in the Lond. "Elec. Rev.," Oct. 5.

Kruppin.—The "Elek. Anz.," Oct. 4, gives the constants of this resistance wire, but the article seems to contain nothing that has not been published before.

Theory of Wimshurst Machines.—In a French Academy paper, by Mr. Shaffers, abstracted briefly in "Cosmos," Oct. 6, he points out certain modifications and simplifications. His conclusions are that straight combs in front of a single plate replace perfectly the horse shoe combs, and that the use of a diametrical conductor in front of each plate will double the efficiency (output?) of the machine. The conclusions were verified by experiment.

Photographing Telephone Oscillations.—Mr. Burch's experiments mentioned in the Digest Sept. 15, are described briefly in the "Elek. Zeit.," Oct. 4. With his arrangement frequencies of 2,500 to 3,000 can still be distinguished from each other.

Measurements with Electrical Radiation.—Dr. Zehnder's paper, mentioned in the Digest Oct. 6, is abstracted briefly in the Lond. "Elec.," Oct. 5.

Electrical Method for Testing Dynamos and Motors.—A French translation of the article by Mr. Lenz, abstracted at some length in the Digest Sept 8, is published in "L'Eclairage Elec.," Sept. 29.

ARC AND INCANDESCENT LIGHTS.

Double Series Arc Light System.—In the "Elek. Echo," Oct. 6, Mr. Schulze describes a system in which a second series of arc lamps is connected to a series wound dynamo in parallel with the first series, which may be accomplished by shunting the field magnets with a fixed resistance, which must be somewhat greater than that of the magnets. When one group of lamps is cut out, this resistance must also be cut out. An apparatus for doing this and the reverse operation automatically, is described.

Light for Photographing.—The Lond. "Elec.," Oct. 5, mentions a system in which 40 incandescent lamps of 25-cp, were placed under a white dome reflector about 3.5 ft. in diameter. The lamps were nominally 65 volts, but were run up to 100 volts during exposure. It is claimed that an exposure of one second will suffice for a portrait. The forced lamps give a fairly good actinic light, and the apparatus seems easy to control.

TRANSMISSION OF POWER.

Polyphase Transmission.—The Lond. "Elec. Eng.," Oct. 5, calls attention to a plant which is being erected at Foligno, Italy, containing three generators and turbines of 100-hp each, generating a current of 2,000 volts. The distance is 4.34 miles. One circuit is to be used for lighting, and the other for motors. It is to be installed by the Oerlikon Company.

Power Transmission in the Transvaal.—A few figures regarding some proposed installations, in one of which 20,000 volts are to be used, are given in the Lond. "Elec. Rev.," Oct. 5.

ELECTRIC RAILWAYS.

Accumulator Traction in Mines.—A paper, by Mr. Libert, read before a Belgian Society, is published in "Ind. & Iron," Oct. 5. He describes an installation carried out last year in an important colliery in the Charleroi district. The paper is quite long, and is well illustrated. Accumulators are used, as a trolley line could not be employed in mines subject to fire damp on account of the sparking.

Electric Traction in the Paris Sewers.—Visitors are taken through the large Paris sewers on a system of railways which have heretofore been run by man power. "L'Eclairage Elec.," Sept. 29, publishes a well illustrated description of an electric locomotive, which is at present being built for driving these cars. It is run by accumulators.

Railways in Vienna.—The "Zeit. feur Elek," Oct. 1, publishes a large map of Vienna, showing the railway systems, accompanied by propositions made by the Electrical Society of that city for the introduction of electric traction. A table gives the number of trips per inhabitant per year on the city railways in some of the largest cities, for 1891, and is as follows: New York, 267; Berlin, 140; London, 116; Hamburg, 90; Paris, 84; Budapest, 59, and Vienna, 46.

Elevated Railway in Berlin.—An editorial in the "Elek. Zeit.," Oct. 4, states that the firm of Siemens & Halske will, in a few days, begin the construction of an elevated electric railway running through Berlin from East to West.

Underground Gravity Road.—According to the "Elek. Anz.," Oct. 4, Mr. Grauel suggests an underground gravity road for the city of Berlin, built in lengths of 3,000 to 6,000 ft., on which power may be used in addition. The greatest allowable speed is given as 1.4 miles per minute.

Waterloo City Railway.—A note on this underground electric railway, which is at present under construction, is contained in the Lond. "Elec. Eng.," Oct. 5. It is referred to briefly also in the "Elek. Zeit.," Oct. 4.

Brussels Railway.—A brief description of the electric railways is published in "L'Elec.," Sept. 29.

Sectional Contact Rail System at Lyons.—The Lond. "Elec. Eng.," Oct. 5, publishes some of the illustrations, with a brief description of the system mentioned in the Digest last week.

Trolley Navigation.—A system used by the firm of Siemens & Halske for supporting the trolley wires on floating buoys for use in lakes and like places, is illustrated in "L'Eclairage Elec.," Sept. 29.

CENTRAL STATIONS, PLANTS, SYSTEMS AND APPLIANCES.

Regulating the Phase in Alternating Current Circuits—In a communication to the "Elek. Zeit.," Oct. 4, Mr. von Dobrowolsky, in referring to Mr. Imhoff's article, abstracted in the Digest, Oct. 13, calls attention to the fact that the over-excitation of alternating current motors in place of condensers for shifting the phase, was known since 1891, when it was described by Mr. Swinburne. The first practical application was made a year and a half ago at his (Dobrowolsky's) suggestion on the Buelach-Oerlikon transmission plant; here the 200-hp three-phase motor of a somewhat old design, was found to consume such a large wattless exciting current, that the primary station, the line and the transformer, were overloaded and the installation could neither operate economically nor be fully loaded; an over-excited synchronous motor at the secondary station, was inserted in the branch circuit behind the transformers, which completely overcame all the difficulties; he claims therefore to be the first to carry out the suggestion practically. He also claims to be the first to patent, in most countries two years ago, the regulation of the phase difference between parallel alternators by changing their relative excitation, as also to introduce phase indicators; the only thing original in Mr. Imhoff's system is the use of the exciting dynamo at the same time as a generator of the wattless current. In an editorial, attention is called to the fact that Dr. Hopkinson in an Institution paper, several years previously to Mr. Swinburne, showed that in a synchronous single-phase transmission, the motor should be excited more than the generator; whether the results gained are warranted by the extra cost must be determined for each case, in most cases this method may show itself to be cheaper, or at the same cost give a higher efficiency; an additional advantage is that a strongly excited motor will not fall out of synchronism with a sudden overloading as one that is weakly excited. With induction motors the regulation of a phase involves increased first cost, as the regulation cannot be affected by the exciting of the motors but requires the addition of a special machine, as described by Mr. Imhoff, in the form of a synchronous motor excited to give a higher voltage than the main current, and which is installed in the receiving station and connected in parallel with the non-synchronous motors; whether this introduction is warranted by the expense must be determined for each case.

Rectifiers.—An editorial in the "Elek. Zeit.," Oct. 4, calls attention to the increasing introduction of rectifiers in England in cases where comparatively few arc lamps are to be run from an alternating current station; such an apparatus requires less space and supervision and is cheaper in first cost than a special engine and an arc light dynamo would be; whether this somewhat complicated apparatus is better will be shown by the experience in those stations.

Hempstead.—An illustrated description of this municipal plant, which

is said to be the first one in the Metropolis installed by the municipality itself, is published in the Lond. "Elec. Rev.," Oct. 5. A somewhat fuller description, including a number of illustrations, is published in the Lond. "Elec. Eng.," Oct. 5.

Arundel.—A well illustrated description of the installation at Arundel Castle, which is the largest private installation in England, is given by Mr. Kapp in the "Elek. Zeit." Oct. 4 (see also Digest, Set. 8).

Worcester.—The Lond. "Elec.," Oct. 5, gives an illustrated description of this station, which is run by water-power.

Ealing.—The switchboard at this installation (see Digest last week) is illustrated in the Lond. "Elec. Eng.," Oct. 5.

Halles.—A translation of Mr. Claude's (article see Digest, Aug. 18) describing and discussing the more recent alterations in this station, is published in the Lond. "Elec. Rev.," Oct. 5.

Lyons Exhibition.—"L' Eclairage Elec.," Sept. 29, publishes an illustrated description of three small stations for the lighting of this Exhibition.

Design and Specification for Electric Lighting Works.—What appears to be a book on this subject for Architects and Civil Engineers by Messrs. Pentland & Gibbings, is being reprinted in London "Electricity," beginning with Oct. 5.

Mercury Commutator.—The Siemens & Grunston form is illustrated in "L'Eclairage Elec.,"Sept. 29; the mercury is covered with a layer of sand which prevents oxidation and the formation of sparks.

High Pressure Turbine.—A short illustrated description of a Van Rysselberghe high-pressure turbine is given in the "Elek. Anz.," Sept. 30.

Utilization of Town Refuse for Generating Steam.—A paper by Mr. Baker, is published in full in the Lond. "Elec. Eng.," Oct. 5.

WIRES, WIRING AND CONDUITS.

Leads for Three-phase and Single-phase Systems.—In an article in the "Rev. d'Elec.," Mr. Chavannes shows by calculation that the belief that in the three-phase system there is a saving of 25 per cent. of copper at the same maximum potential is erroneous, and that the weight of copper is absolutely the same in the two systems. He states that if in a single-phase system the mean potential between a wire and the earth is 500 volts it will be 1,000 volts between the wires, while in a three-phase system if each wire has a mean potential of 500 volts relatively to the earth, that between two of the conductors will be 866 volts; these two cases cannot be compared in determining the cost of the copper as they should be compared at the same volts and not at the same potential between the line and the earth, which latter has no significance, even in calculating the insulation, as that should be calculated on the basis of one of the conductors being connected to the earth, in which case the two voltages would be 1,000 and 866; the two systems should be compared for the same E. M. F., indicated at the voltmeters at the station; by taking the above case he finds that the copper in the tri-phase system will be to that in a simple system as two is to the square root of three, which is quite different from a saving of 25 per cent. He calculates an actual case for transmitting 100-hp with 10-hp lost in the lines and a voltage of 1,000 at the station; in the single-phase system the current will be 73.6 amperes and the resistance will be 0.68 ohms for one lead; in the tri-phase system the current will be 245 amperes, or as each of the conductors supplies two circuits, the current in each will be 49 amperes and the resistance 1.02 ohms; from this he concludes that the weight of the copper of the two lines is exactly the same as that for the three lines, showing that the systems are identical; the only difference is that the potential of the tri-phase lead relatively to the earth is 580, while for the single-phase system it is 500.

Protecting Fuse.—An arrangement devised by Mr. Wahlstroem is described in the "Elek. Anz.," Sept. 30, and is intended for cases in which the fuse wire would be too thin to be practicable; he uses a short carbon filament, to which are fastened two thin metallic wires; a strong current will fuse the carbon and if this does not stop the current an arc will be formed, which will burn off the metallic wires until the arc is of such a length that it can no longer be maintained.

Double Wire.—The Grammont system is described and illustrated in "L'Energie Electrique," Oct. 1; two well-insulated wires are kept apart by a flexible material and the whole is enclosed with a braiding, forming a double flexible cable,which is nailed directly to the walls through holes in the bridge piece made for that purpose.

Underground Wires.—According to "L'Eclairage Elec.," Sept. 29, the General Electric Co., of Berlin, has adopted a new system in which the conductors are contained in conduits formed of a metal spiral surrounded by a porous covering which drains off the water.

High Tension Insulator.—The Ferranti system is illustrated in "L'Eclairage Elec." Sept. 29; the wire is secured transversely to a stretched vertical support made of some fibrous material, which is continually kept saturated with oil.

Rules and Regulations.—"L'Energie Electrique," Oct. 1 (vol. 1, No. 1), begins to publish the laws of France concerning the running of the leads of all sorts in public streets.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Induction Systems.—An editorial in the "Elek. Zeit.," Oct. 4, calls attention to the results obtained by Preece and Stevenson, and states that the views of the latter that coils are better than parallel wires, is in general not correct; when weak currents are used coils will, in most cases, give the best results, but when stronger currents are used parallel wires would doubtless always be the best. The limiting distance for such communication has been increased from 1.8 to 4.8 miles. It suggests the use of such a system in case of war; if for instance, in the neighborhood of a fortress several wires are laid in the sea, of which one carries an alternating current, the induction on the others will be appreciably changed as soon as an iron vessel approaches the wires.

Trans-Atlantic Telegraphy.—In the note on trans-Atlantic telephony in "L'Elec.," Sept. 29, a suggestion by Mr. Adderis given for utilizing the telephone as a telegraphic receiver; at the receiving station the lines divide into two branches connected to two interrupters which have different rates of vibration; the arriving current will always meet a current in the same direction in one of these branches and a current in the opposite direction in the other, increasing the sound in the telephone in one of the circuits and decreasing it in the other; both telephones are held to the ear; a positive current, for instance, corresponds to an increase in the sound and a negative current to a decrease, thus enabling the signals to be distinguished from each other; the chief objection is that no record can be kept.

Telegraphy in Great Britain.—The "Elek. Zeit.," Oct. 4, contains an article by Mr. West, giving a history from 1837 up to the present time.

Telephone Switchboard.—Mr. Engelmann, in the "Elek. Zeit.," Oct. 4, describes and illustrates an arrangement by means of which certain objections are overcome,especially when the circuit includes two central stations.

Tower for Overhead Wires,—In an article by Mr. Pellissier in "La Nature,"Oct. 6, he gives an illustrated description of the tower for overhead wires on the Telephone Central station at Antwerp.

Time Distribution.—The system which is now being introduced in Berlin, and in which compressed air and electricity are used, is described in the "Elek. Anz.," Sept. 30; the clocks are set every four hours and the charge is 50 cents per month per clock.

ELECTRO-CHEMISTRY.

Electro-chemical Preparation of Accumulator Plates.—In the "Electrochem. Zeit." for October, Dr. Schoop gives an interesting summary of all the various forming processes which have been applied in practice. They are briefly as follows: Epstein boils the lead plates for several days in a solution containing 1 per cent. of nitric acid; after the coating is one millimeter thick the plates are dried in the air; the last traces of nitric acid are removed by placing the plates as cathodes in a dilute solution of sulphuric acid containing some copper sulphate and passing a current until the lead is completely reduced to spongy lead; the plates are then peroxidized in sulphuric acid containing pyro-tartaric acid. Dujardin forms the plates directly in a moderately concentrated solution of sulphuric acid and nitrate of sodium; Lucas removes the last traces of nitrates by treating the plates with ammonia and then heating them to above 200° C. Boettcher uses a forming mixture of sulphuric acid, acetic acid and water. Swan produces a coating of white lead by the well known white lead process. Duncan produces a coating by making the plates the anodes in a bath of a solution of oxide of lead in potash. Schoop states that in several days lime water will produce a moderately deep action. If lead plates are electrolyzed in a solution of lead sulphate in pyro-tartarate of ammonium, at a certain current density and temperature a strongly adherent crystalline peroxide will be formed on the cathode. Perhaps the surest way of loosening the surface of the lead is by using a solution of bisulphate of sodium and chlorate of potassium, taking five parts of the former, 0.7 parts of the latter and 95 parts of water; plates about 4 in. square are treated with ⅓ ampere for 72 hours at 25° C.; when the action has penetrated about two millimeters, the coating is reduced to spongy lead in a 5 per cent. solution of sulphuric acid with one ampere; they are then thoroughly washed and heated in the air to nearly the melting point of lead. Plates may also be prepared in an electrolyte of sulphate of ammonium and hydro-fluoric acid. He describes the Howell process used by Crompton, in which kitchen salt is stirred into molten lead when near its point of solidification; this mass is then sawed into plates and the salt then dissolved out. The proposition to make an alloy of lead and zinc and then dissolve out the zinc, does not seem to have been carried out. An amalgam of lead from which the mercury has subsequently been removed, does not appear to be practicable. Rechanzaun prepares the surface of the plate by causing an arc to be passed over it, which melts the surface and oxidizes it. In conclusion he states that it is more profitable to peroxidize plates by an electro-chemical process than to use mechanically applied material.

Chemical Theory of Accumulators.—In the third article of Mr. Wade, in the Lond."Elec.," Oct. 5, he describes the laws of Faraday and Lord Kelvin by means of which the E. M. F. may be calculated, and applies them to a number of the theories of the action in the lead accumulator, showing that in every case the calculated E. M. F. falls far short of what is required.

Guaranteeing Accumulators.—An article in the "Electrochem. Zeit.," for October, discourages the practice of guaranteeing accumulator installations, as it involves a loss of capital either to the consumer or to the manufacturer, and is an admission that accumulators require a guarantee.

Velvo Battery.—In the Lond. "Elec. Rev.," Oct. 5, Mr. Barnet replies to some criticisms of his Velvo carbon battery (see Digest, Oct. 6, 13, 20). He finds that one cent's worth of mercury is sufficient for amalgamating each pound of zinc; he does not see how a percentage of efficiency for zinc consumption can possibly be given in any other way than ampere-hours, as there is no theoretical limit to the E. M. F. and consequently to the watts obtainable; the efficiency of a battery should be expressed in terms of all the materials used, and if a pound of chromic salt is used to save a pound of zinc the loss in economy is apparent. From a description begun in London "Electricity," Oct. 5, it appears that the velvet-like carbons for this battery are platinized before carbonizing so as to form a finely divided platinum coating on the velvet-like surfaces; the other features of this battery have already been described in these columns.

Chlorine and Soda.—In an article in the Lond. "Elec. Rev.," Oct. 5, Mr. Andreoli criticizes a recently published description of the Castner process (see Digest, Oct. 13, 20); he states that there is no radical difference in this apparatus, as it is like that which was and is still used in the electrolysis of fused salts; the use of a moving body of mercury is not new, as all electro-chemists who have used mercury have used it in that way; he claims that it is not the only process which generates no hypochlorite nor the only one in which an efficiency of 88.9 per cent. is obtained. He quotes from the "Engineering and Mining Journal" of New York, Sept. 22, in which a description by Mr. Castner is published; he admits that the Castner process may be extremely good, but claims that it is not better than any good process based on the employment of mercury.

Production of Chlorate of Potash.—Two electrolytic processes are described in the "Elek. Tech.," Sept. 30.

Enamelling.—The Haswell process is mentioned but not described in the "Elek. Tech.," Sept. 30; it consists in coating metals, like iron and steel for instance, electrolytically, with a very hard and resisting metallic oxide. One of the advantages seems to be that any flaws or cracks, even when invisible, are brought out by the process; the absence of such flaws is therefore guaranteed when objects have been coated by this process; for this reason it is suggested to use it for the axles of railroad cars, as an assurance against the existence of flaws.

Testing Baths.—Dr. Krueger begins an article in the "Electrochem. Zeit.," for October, in which he calls attention to the great importance of frequently testing the constituents of plating baths; he intends to describe some simple methods requiring but little knowledge of chemistry. To determine the amount of metal in a bath he recommends the electrolytic method.

Tin from Tinned Iron.—"L'Eclairage Elec.," Sept. 29, mentions that according to a recent patent, tin plate is heated in soda and sulphur or in a solution of sulphide of sodium, for forming the sulphostannate of soda; to this solution ammonia, or sulphate of ammonia, is added, after which the bath is electrolyzed.

Aluminium.—The Nauhausen (Switzerland) plant is at present producing three tons per day and has reduced the price to 36.4 cents per pound.

MISCELLANEOUS.

Electricity in Aeronautics.—In an editorial in the Lond. "Elec. Rev.," Oct. 5, attention is called to the great danger to the life of the operator in making experimental trials, and it is recommended that Mr. Maxim and others should perform their experiments with electric motors connected to the ground with cables, as in that case the element of personal danger is practically eliminated and the whole machine could be actuated and directed from a safe distance. Attention is also called to the afact that an electric motor is at least as light per horse-power as any other motor. Mr. Trouve has constructed an electric motor developing at the rate of one hp for each 7 pounds of weight (the total hp or the total weight is not given).

Application of Motors.—In an article begun in the Lond. "Elec. Rev.," Oct. 5, a description, accompanied by a large number of good illustrations, is given of the application of motors in factories for various purposes. The description includes the application to a number of cranes.

Electricity on the Stage.—According to the "Elek. Zeit.," Oct. 4, the Court Theatre in Munich is installing a plant by means of which all the mechanical work on the stage is to be done by electric motors.

Electric Heating.—An illustrated description of a device is shown in the Lond. "Elec. Rev.," Oct. 5. The vessel is either conducting or contains a ring of conducting material, such as lead or fragments of carbon. This forms the secondary of a coreless transformer placed directly beneath the apparatus (a similar suggestion has been made several times before).

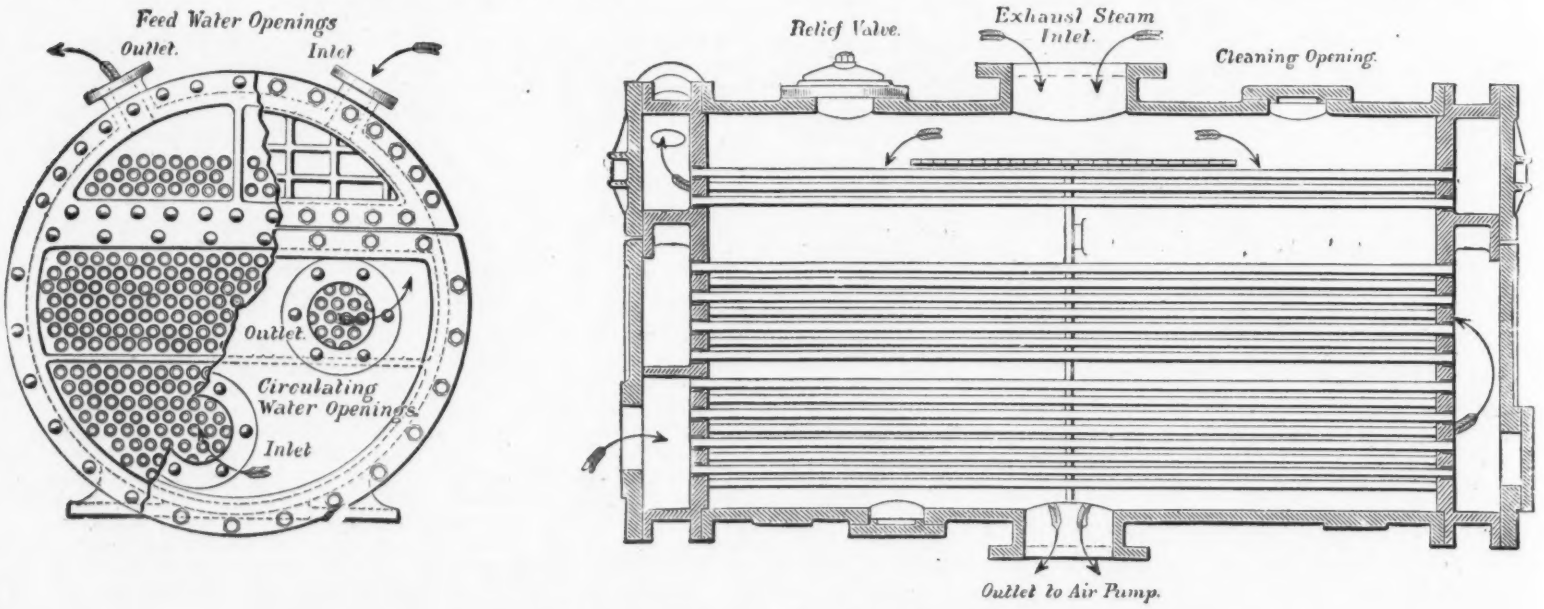
Taussig Smelting Process.—A brief description, taken apparently from the United States Consular reports, is published in the Lond. "Elec. Rev.," Oct. 5.

Electrically Lighted Life Buoy.—The Meller system adopted by the General Electric Co., of Berlin, is described in the "Elek. Anz.," Oct. 4.

Lightning Flash.—The Lond. "Elec.,' Oct. 5, reproduces a photograph of a flash of lightning taken in the day time, showing a broad band with a bright edge. It also reproduces an illustration from Prof. S. P. Thompson's paper, on the discharge of an influence machine, showing bright illuminated points at the corners of the zigzag paths.

The Volz Condenser and Feed-Water Heater.

The Volz patent combined surface condenser and feedwater heater (formerly furnished by The Standard Condenser Company) is now offered by the Wheeler Condenser & Engineering Company, which has purchased the patents covering this apparatus. They have also made arrangements with Mr. Wm. E. Volz, the patentee, to represent its interests in this connection as sales agent, together with the Wheeler condenser and other of its specialties, and is placing upon the market a line of apparatus which is in keeping with the rapid advancement of steam engineering.



Combined Surface Condenser and Feed-Water Heater.

The advantages of a simple and efficient feed water heater have long been recognized as a desirable auxiliary to both stationary and marine engines, not only for the purpose of economizing fuel, but also of insuring a longer life of boilers.

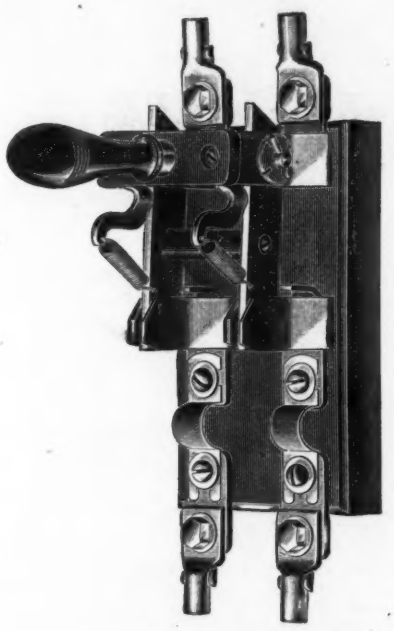
This object has heretofore been attained when using a surface condenser, by independent or separate feed water heaters placed between engine and condenser. These are expensive and require considerable extra space, besides often impairing the vacuum in the condenser because of contracted steam passages.

The most important feature of the company's patent combined surface condenser and feed water heater, is the combination of a surface condenser with a feed water heater—the latter being a simple, efficient and compact apparatus built within the condenser casing and herewith briefly described. The exhaust steam from the engine passes through the exhaust pipe in the usual manner, enters the top of the condenser and expands over the upper or heater tubes, imparting the heat through the medium of these tubes to the feed water; then passes to the lower or

condenser tubes, where, after condensation, the water is returned from air pump and hot well to the feed water heater, and thence to the boilers.

As the hottest steam in this case meets the hottest water, avoiding the sudden change of temperature between exhaust and circulating water, experience has shown that the condenser tubes are more durable, and the vacuum more uniform in this type of condenser than without the feed water heater. Heater and condenser tubes are usually of the same diameter, but the former are made heavier; the feed water is split up in many small streams, extracting all the available heat from the exhaust steam, and ample provision is made for the proper expansion of the tubes. The condenser is fitted with automatic relief valves and may be operated with or without the feed water heater. The tube heads, feed and circulating water chambers are made in one composition casting with all division plates cast in, thereby avoiding joints between the feed and circulating water; separate heads or bonnets are provided, allowing access to either set of tubes; this efficient combination of heater and condenser is the result of close study gained by long experience.

The condensers are now used in many of the large electric light and power plants, and other establishments; also on many steam vessels where they were first introduced and are said to have given excellent results in every instance.



COPER SNAP SWITCH.

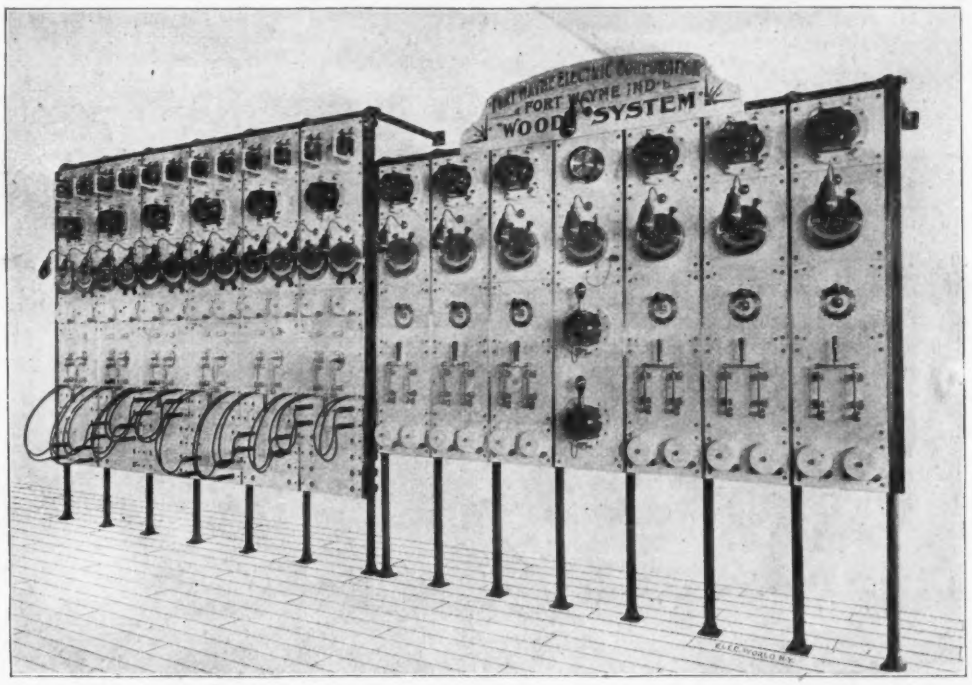
New Station Switches.

The General Electric Company announces a new line of station switches to meet the demand for a reliable switch, which, though sold at a low price, will nevertheless be as durable and effective in work as the higher priced goods. It is known as the Coper Snap Knife switch and differs from the generality of station switches in that the contacts and lugs, instead of being of cast metal, are of pure copper stampings, the contacts having ample surface to avoid heating and consequent loss. The hinges of the blades which move in the back contacts are so designed as to give excellent conductivity. The handle and cross bar are connected to the blades by strong spiral springs, which pull the blade out, with a quick break action, only after the spring is in considerable tension. Thus the danger of arcing is reduced to a minimum. The switches are mounted on bases of hard white porcelain, made by the General Electric Company at its own works at Schenectady, and are constructed in sizes from 75 amperes to 300 amperes, double and triple pole, with and without fuse holders.

Wood Sectional Switchboard for Alternating Systems.

We illustrate herewith the new sectional alternating current switchboard designed by Mr. J. J. Wood, and built by the Fort Wayne Electric Corporation, of Fort Wayne, Ind., for a plant at Austin, Texas.

This board is constructed in two main sections, one of which is designated the "dynamo" board, and the other the "distributing" or "feeder" board. Each of these sections is built up of independent panels, each panel representing either a dynamo circuit complete or a feeder circuit complete. The panels are fitted with primary fuse boxes, ammeters, voltmeters, station transformers, in fact all the requirements of a modern switchboard down to a time clock.



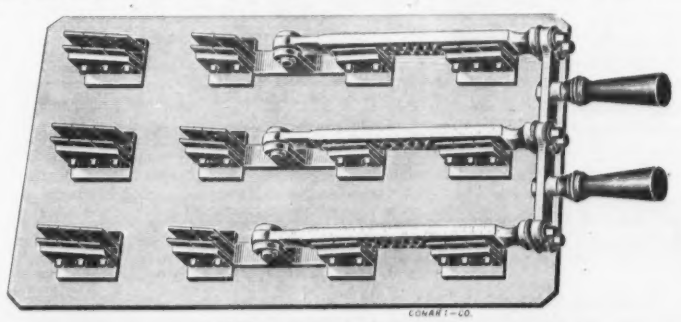
SECTIONAL ALTERNATING SWITCH BOARD.

The board presents a very handsome appearance, and the wiring and method of changing circuits is exceedingly simple, it being practically impossible to make a wrong connection. The value of this type of switchboard to a central station may be realized from a detailed description. The dynamo circuit is connected to a primary fuse box which is of new design and capable of withstanding 150 amperes at 2,200 volts. This fuse box is constructed in such a manner that the gas generated by the blowing of the fuse ruptures the arc. The other terminal of the fuse box is arranged to be connected with the feeder board with a double-pole single throw switch, which is also of improved design. These connections are made through a set of bus bars arranged to be connected with plugs as shown, and put in circuit with the feeders by a double-pole double-throw switch. The arrangements of plugs and connections is such that during the act of transfer there is no current at the terminals. By the system of plugs arranged any dynamo can be thrown on any feeder, it being absolutely impossible to multiple-arc the circuits.

The board is also equipped with a new style ground detector which is exceedingly handsome in appearance, and is, at the same time, so sensitive that the slightest ground is detected and brought to the attendant's notice. The transformer is also of new and improved design. Another novelty is the adoption of a standard voltmeter, so arranged and connected as to be connected with any dynamo in the station. This method guarantees that the voltage of the dynamo will be the same, and effectually obviates the errors due to different readings of several instruments effected, as they so often are by external magnetism. The illustration given is from a photograph taken while the board was at the factory.

A Large Switch.

The illustration shows a new switch manufactured by the W. S. Hill Electric Company, Boston, Mass., for railway and central stations. For the past year these switches have been in use in very large numbers, one power station alone having over 300 in use of from 500 to 4,000 amperes capacity. The improvements consist in broadening the



4000 AMPERE SWITCH.

ends of the blades and yoke so as to admit of using two bolts, thus uniting the two so firmly as to prevent all twisting or straining of the parts while the switch is being operated. The method of backing up

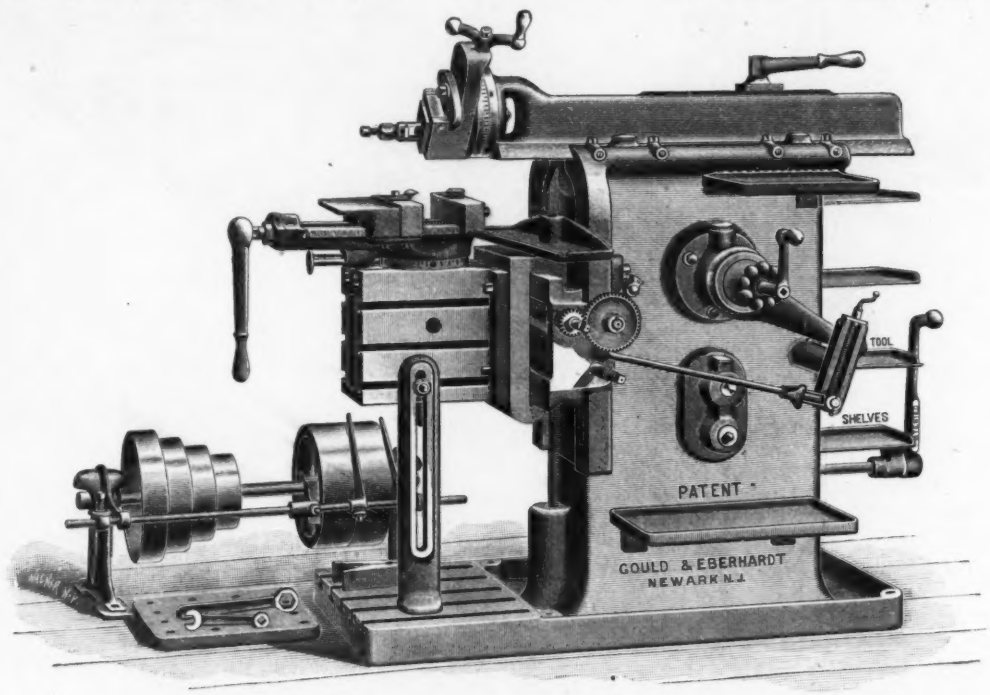
the flexible brush contacts by plates of pure copper, practically converts the blade and contact into one continuous piece of metal, and as the size of all the carrying parts are computed at 1,000 circular mils per ampere, it will be seen that the area is amply sufficient.

An Improved Shaper.

The accompanying illustration represents a new shaper brought out by Gould & Eberhardt, Newark, N. J. It is operated by an improved crank motion and is positive in length of stroke and will plane to a line, which is essential where accurate results are required, as in die work, etc. This motion also gives an unusually quick return stroke, by which, on short work, double the usual number of strokes can be obtained. All bearings are large and long, especially the bearing of the ram in the frame. Indexes are provided to tell the workman the length of stroke for which the machine is set at any position of the ram, also for changes of feed, which are made by means of screw and crank. Work can be fastened in a variety of ways, for which provision is made. The vise swivels and is graduated to set at any angle and can also be fastened to the side of the angle.

By removing the angle, work can be fastened to this part direct. A surface plate also permits work to be done which is otherwise impossible. The rise is provided with a pair of adjustable centres, for planing small work, fluting reamers, taps, etc., and a pair of special jaws for holding taper work. An improvement especially noticeable on this shaper is the extension base which, besides giving a large foundation to the machine, acts as a support to the work table, thus increasing the accuracy of the work when taking heavy cuts. The design of the base is such as to form a pan around the machine to catch oil drippings, etc., and thus preserve a neat appearance to the floor around the machine.

New Trolley Wheel.



An Improved Shaper.

New Trolley Harp and Wheel.

Among several new specialties of the Hubley Manufacturing Company, Lancaster, Pa., is a new trolley harp and wheel, illustrated herewith. The trolley wheel, a section of which is shown in the cut, has its edge protected by a bead, to give it greater strength and prevent it from cutting and otherwise injuring the overhead fixtures or wire. The wheels are designed to give a long service, and are made of special high grade bearing bronze, and, as will be seen by referring to the cut, the metal is placed in the direction of the wear. The spokes are similar to those used on the other high grade wheels, and will not allow the edge to drop off in case it should be worn through. The hub has a large diameter, a good contact with the springs, and is fitted with the best anti-friction bushings. In the harps are combined the two essential qualities of lightness and strength. They are made of the best malleable iron and high grade bronze, both having steel shanks. The sides are made with a crescent section and offer a rounded surface to prevent catching or cutting the overhead fixtures, which gives also a handsome appearance.

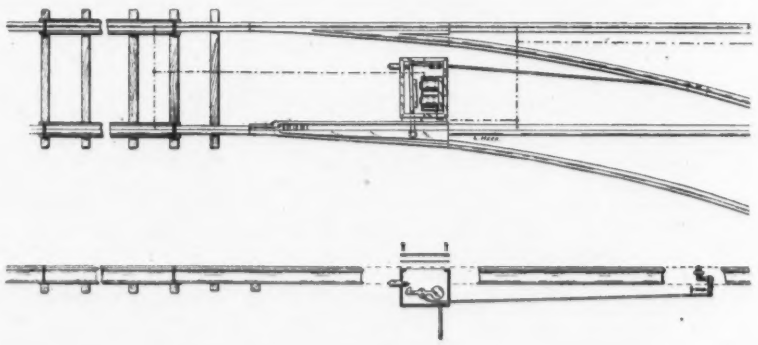
The Canal Tugboat.

In the article by Mr. F. M. F. Cazin under the above caption in our issue dated October 6, there is a typographical error in the 13th line from the bottom of the second column on page 345. In the equation for P_1, expressed in kilogrammes-metres, the term $\frac{V^3}{2}$ should be $\frac{V^3}{2g}$

A New Track Switch.

The accompanying cut illustrates an automatic electric traction switch which has recently been patented by Messrs. Walter V. and Joseph H. Ash, of Newark, N. J. The device consists of an ordinary tongue switch of such dimension that it can be set in place of a regular tongue switch without alteration of the track. The tongue is operated by two electro-magnets, which are placed horizontally in a water tight iron casing bolted to the side of the switch between the tracks. The electro-magnets actuate an armature, which is connected by means of a short vertical shaft, extending, at its upper end, under the heel of the tongue to which it is rigidly keyed.

The terminals of the windings of the electro-magnets are connected to the bonded rails and a pair of insulated rails respectively, being excited by the current from the motor car while in motion. The operation of the switch is as follows: The main line being always open, as soon as the car which is to leave the main line runs on the insulated rails with a small current on its motors, its current will excite the magnets by passing from the insulated rails through their winding to the bonded rails beyond; the magnets will instantly attract the armature, which, being connected rigidly to the tongue, will throw it over, thus opening the switch. This is locked in position by a self-acting latch, which is released by the car passing over the tripping device placed in the head of the rail beyond the switch. The cars bound for the main line will of course have to drift over the insulated rails without current on their motors. Under the point of the tongue the switch is perforated to allow stones, dirt, snow, etc., to drop into a box beneath which is connected with the sewer, making it self-cleaning. The switch which has been in operation on the lines of the Consolidated Traction Company,



Automatic Track Switch.

Newark, N. J., cor. Bridge and Broad streets, since Sept. 17, is reported as giving excellent satisfaction to the officials of the Traction Company. The switch was constructed and tested in the shops of the Stucky & Heck Electrical Manufacturing Company, No. 35 New Jersey Railroad avenue, Newark, N. J. They will be placed on the market by the Ash Automatic Electric Switch Company, of which Mr. Jos. Samuel is president and Walter V. Ash, general manager.

Financial Intelligence.

THE ELECTRICAL STOCK MARKET.

NEW YORK, Oct. 20, 1894.

ELECTRICAL STOCKS attained unusual prominence during the financial week ending to-day, but for the most part it has been secured at the expense of quotations, all the activity having been on the bear side. The managers of the various big electrical manufacturing companies still persist in declaring that business is much improved, but there are many who want to know where any profit comes in when car equipments, for instance, sell for $650 per car or even less, and it is due to the currency of such doubts as to any ability to earn money that has led to the recent onslaughts against the stocks of the electrical companies.

GENERAL ELECTRIC, as usual under such circumstances, has been the chief target of the bear clique and they have been as reckless as ever in promoting all kinds of stories detrimental to the company's standing. That the bears have been as successful as the record of the week's transactions evidence is due, however, more to the lack of support from the Company's friends than to any general belief in the bears' tales. The operators on the down tack make the point—admittedly supplied them by the Company's competitors—that General Electric is selling its products at prices 50 per cent. below those current a year ago and that it is pursuing its old methods of getting business at any cost, now, however, merely cutting prices, where formerly it made concessions in the manner and time of payments. The chief cause of the week's decline is more due to the great abundance of stock and its consequent easy manipulation than to the genuineness of the bear stories. The Company's officials aver that its works are running practically full time and full force on a cash basis. The volume of gross business, considering the times, is very satisfactory, being considerably larger than it was a year ago and about 70 per cent. of the normal. Net returns are also fairly good and there is declared to be absolutely no truth in the reports that business is being taken at a loss. As to its financial condition, General Electric now has about $500,000 cash in its treasury, has no floating indebtedness and has in the last two months redeemed and cancelled $700,000 of its debenture bonds. What, however, must militate against any decided improvement in the stock's quotation is the uncertainty still attending the correction of the odd $12,000,000 capital impairment.

WESTINGHOUSE ELECTRIC issues have remained stationary. There is hardly enough of these shares floating around to admit of much speculation, but there is always sufficient doing to furnish an index as to current conditions. Boston gossip has it that a common stock dividend could be paid without putting the Westinghouse Company's resources to any unusual strain. There has been some unusual expense in the new buildings, but the economies in operation promised will pay for them in a short time. From Pittsburg comes what purports to be official information to the effect that the company has in hand more and larger orders than ever before in its history, and all taken on a practically cash basis; that its present works are so over-crowded that the operatives have hardly elbow room; that the works are going day and night; that, while the new plant at Brinton is being pushed to completion as rapidly as possible, it will be some time before the Company will be able to occupy the works; that the new glass factory in Allegheny for the manufacture of electric light bulbs, to be occupied Nov. 15, will be the largest works of the kind in the country. Knowledge of all these facts is probably at the bottom of the current strength and even advance of Westinghouse issues.

AMERICAN BELL TELEHPONE is again down. While selling has been limited the demand is poorer and the stock continues to slump. It comes from authentic sources that the Company will soon issue 10,000 shares ($1,000,000) new stock, and the selling is attributed to this cause, the argument being that investment holdings now let go can be replaced at a lower price either at the auction sale or in open market. The company is understood to be organizing a syndicate to underwrite the first auction sale at 190. The income of the company continues satisfactory. The Long Distance Company continues to pay its 5 per cent. dividends to the Bell company, while the New England and some other subsidiary companies are increasing the dividend payment.

THE ERIE TELEGRAPH AND TELEPHONE people, since the stock was listed in New York, are trying to give it prominence by furnishing on different occasions figures as to business and earnings. Net earnings for July and August are reported as being $66,637, an increase of $4,559. For the three months ending September 30, there was a net gain of 252 exchange subscribers, the total being 14,667. The total of subscribers connected on Sept. 30 was 15,780. The stock is off 2 points in the price bid.

WESTERN UNION continues to be sold down, the directors all the time putting out statements that "the decline, in view of the excellent showing of the annual report, is inexplicable." Nothing new develops as to the company's condition, business continues satisfactory and the decline is apparently purely a speculative movement. There are hints of inside selling, but no justification of the rumors are offered.

THE STREET RAILWAY AND ILLUMINATING PROPERTIES furnishes some interesting figures for its first year of operation. The company bought from the General Electric Company $12,188,266 in securities and received from other companies against advances, etc., $683,517, amounting in all to $12,871,784. Of this sum $2,472,229 of securities at par value have been disposed of, leaving $10,399,555 now held by the trustees. The company has received from the sale of various securities $1,314,155, and has paid $1,250,170 for 13,561 shares of preferred stock. The balance from the sale of securities was expended in advances to various companies and in purchase of additional securities. There was $238,957 received as interest, of which $168,242 was paid in dividends on preferred shares and $57,088 in expenses of trust, leaving a balance of $13,627

BROOKLYN EDISON ELECTRIC LILUMINATING stock is somewhat higher by reason of the scarcity of the security in the market, and the continued good business of the company. The stock is now quoted at 109, which is 7 points higher than the stock of the New York Illuminating Company.

ELECTRICAL STOCKS.

	Par.	Bid.	Asked
Brush Ill., New York	50	10	30
Cleveland General Electric	100	80	90
Detroit Electrical Works	10	3	4
East River Electric Light Co.	100	—	50
*Edison Electric Ill., New York	100	101½	102½
" " " Brooklyn	100	109	110
" " " Boston	100	120	121
" " " Chicago	100	135	145
" " " Philadelphia	100	122	124
Edison Electric Light of Europe	100	1	3
Edison Ore Milling	100	10	15
Electric Construction & Supply Co., com.	15	7½	10
" " " " pref.	15	7½	10
Fort Wayne Electric	100	2¼	2¾
General Electric	100	35⅛	36
General Electric pref	100	65	70
Interior Conduit & Ins. Co.	100	25	35
Mount Morris Electric	100	25	50
Westinghouse Consolidated, com.	50	35½	36
* " " pref	50	52½	53½

BONDS.

*Edison Electric Ill., New York	1,000	107½	108
Edison Electric Light of Europe	194	75	85
General Electric Co., deb. 5's	1,000	88	90

TELEGRAPH AND TELEPHONE.

*American Bell Telephone	100	198½	199½
American District Telegraph	100	40	45
American Telegraph & Cable	100	90½	91
*Central & South American Telegraph	100	101½	105
*Commercial Cables	100	125	145
Erie Telephone	100	54	56
Gold & Stock Telegraph	100	103	105
*Mexican Telegraph	100	180	190
New England Telephone	100	67	69
Postal Telegraph-Cable	100	54	60
*Western Union Telegraph	100	88	89

* Ex-div.

NEW INCORPORATIONS.

THE IRONTON STREET RAILROAD, LIGHT & POWER COMPANY, Ironton, Ohio, capital stock $100,000, has been incorporated.

THE NORTH SHORE ELECTRIC ROAD, Chicago, Ill., capital stock $10,000,000, has been formed by J. L. Cochran, D. H. Louderback and Dunlap Smith.

THE JAMESTOWN & LAKE ERIE RAILWAY COMPANY, Albany, N. Y., capital stock $250,000, has been incorporated. The road will skirt the shores of Chautauqua Lake.

THE CLIFTON PARK PASSENGER RAILWAY COMPANY, Baltimore, Md., capital stock $50,000, has been chartered and will erect a power plant to operate its proposed street railway.

THE PITTSBURG TROLLEY POLE COMPANY, Pittsburg, Pa., capital stock $5,000, has been incorporated by John D. Biggert, R. S. Robb and Sam R. Wilson, to manufacture iron or steel or both.

THE SUMMIT IMPROVEMENT COMPANY, Summit, N. J., capital stock $30,000, has been formed to generate and supply electricity. William Halls, Jr., Chas. E. Kimball and Thos. F. White, of Summit, are interested.

THE LAKE SHORE ELECTRIC RAILWAY COMPANY has been incorporated with a capital stock of $10,000,000. This line will run from Chicago to Milwaukee, and will be equipped with the latest and best machinery.

THE ANTO-ELECTRIC COMPANY, Grand Rapids, Mich., capital stock $15,000, has been formed to manufacture and sell electrical apparatus. Fred C. Norris, Lansing; E. F. Sweet and W. S. Burnett, Grand Rapids, Mich.

THE DUNDEE ELECTRIC LIGTH COMPANY, Dundee, Mich., capital stock $12,000, has been formed to generate and sell electricity. Cora Watkins, Ida Avis, George T. Avis and D. H. Chapman, of Hudson, Mich., are interested.

THE DAUPHIN LIGHT, HEAT & POWER COMPANY, Harrisburg, Pa., capital stock $50,000, has been incorporated to supply light, heat and power by electricity. Joseph Pyne, Mercer R. Tate and J. Grant Koons are interested.

THE WHITTINGHAM ELECTRIC CAR HEATING COMPANY, Baltimore, Md., maximum capital stock $100,000, has been formed to manufacture, sell, etc., heating or other apparatus, and generally for the purpose of dealing in such.

CAPE GIRARDEAU WATER WORKS & ELECTRIC LIGHT COMPANY, Cape Girardeau, Mo., capital stock $100,000, has been formed to operate a light and water plant. Leon J. Albert, David A. Glenn and R. E. Gannon, Cape Girardeau, Mo.

THE CHICAGO CENTRAL ELECTRIC RAILROAD COMPANY, Chicago, Ill., capital stock $1,200,000, has been incorporated to construct and operate street railroads. George W. Waterman, Wm. R. Odell and Charles A. Boos are interested.

THE EASTERN TRAMWAY CONSTRUCTION COMPANY, Jersey City, N. J., capital stock $2,000, has been formed to construct and equip electric railways. Howard Ellis, Ridgewood, N. J.; John E. Bowles and George H. Wright, New York, are interested.

THE IRONTON STREET RAILROAD, LIGHT & POWER COMPANY, Ironton, Ohio, capital stock $100,000, has been formed to operate a street railroad and furnish light and power. H. A. Marting, Leo Ebert and R. Mather are the interested parties.

THE NEW ATHENS ELECTRIC LIGHT & POWER COMPANY, New Athens, Ill., capital stock $4,500 has been incorporated to furnish New Athens with electric light, heat and power. Isfried Probst, Paul Lehman and Frank Fenerbacher are interested.

THE WILLIAMS VALLEY STREET RAILWAY COMPANY, Girardville, Pa., capital stock $100,000, has been formed to construct, maintain and operate an electric railway. Charles A. Barnhard, Moses Mervine and George C. Hachel, Girardville, Pa., are interested.

THE HOME TELEPHONE COMPANY, Uniontown, Pa., capital stock $6,000, has been incorporated by Wm. C. McCormick, Albert Inks and O. J. Sturgis, to

construct and operate a telephone line from Uniontown, Fayette county, to Scottdale, Westmoreland county, Pa.

THE ELECTRIC MESSENGER COMPANY, Pittsburg, Pa., capital stock $20,000, has been incorporated to build and maintain telegraph and telephone lines and exchanges. W. S. Miller, J. N. Pew, Pittsburg; W. T. Marshall, Alegheney, City, Pa., are the incorporators.

THE KEY WEST LIGHT & POWER COMPANY, Key West., Fla., capital stock $125,000, has been incorporated to operate an electric light plant. The promoters are John J. Philbrick, president; George W. Allen, secretary, and Joseph S. Whalton, Jr., treasurer.

THE KANSAS CITY TRACTION COMPANY, Kansas City, Kan., capital stock $1,000,000, has been formed, to acquire, construct and maintain a street railway. B. S. Coler, Brooklyn, N. Y., and Wm. J. Smith and Wm. H. Lucas, Kansas City, Mo., are the interested parties.

THE GRAFTON ELECTRIC COMPANY, Grafton, Mass., capital stock $10,000, has been formed to generate, sell and distribute electricity for light, heat and power. Clarence R. Pratt, Clarence McClelland, George W. Fisher, Charles L. Pratt and Charles H. Miles are interested.

THE WAYNE ELECTRIC LIGHT STEAM & HEAT COMPANY, Wayne, Pa. minimum capital stock $1,000, has been incorporated to supply light, heat and power by means of electricity. Herman Wendell, Frank Smith, Wayne, and W. B. Smith, Philadelphia, Pa., are the promoters.

THE ASH AUTOMATIC ELECTRIC SWITCH COMPANY, Newark, N. J., capital stock $250,000, has been formed to manufacture and sell automatic electric traction switches, etc. Joseph Samuel, Walter Voorhis Ash, Joseph Hardy Ash and Moses Hirsch, Newark, N. J., are interested.

THE BETHLEHEM & NAZARETH ELECTRIC STREET RAILWAY COMPANY, Bethlehem, Pa., capital stock $100,000, has been formed to construct, maintain and operate an electric street railway. Ashton C. Borhek, Albert Broadhead and Abraham Schropp, Bethlehem, Pa. are the promoters.

THE EAST LIVERPOOL TELEPHONE ELECTRIC COMPANY, East Liverpool, Ohio, capital stock $10,000, has been incorporated to construct and operate a telephone system, and to furnish electric light and power, etc. James C. Diedrick, T. A. Corcoran and G. W. Meredith are the promoters.

THE IMPERIAL ELECTRIC BELL & FIRE ALARM MANUFACTURING COMPANY, Huntington, W. Va., has been incorporated to manufacture W. J. Schweiger's patent electric bell and fire alarm apparatus, etc. James K. Oney, E. B. Enslow and C. E. Gwinn, all of Huntington, are interested.

THE AKRON, BEDFORD & CLEVELAND RAILROAD COMPANY, Akron, Ohio, capital stock $300,000, has been formed to construct and operate an electric railroad, and to generate electricity for light, heat and power, etc. John F. Sieberling, F. A. Sieberling and Jas. Christy, Jr., are the promoters.

THE PEEKSKILL & CORTLANDT ELECTRIC RAILWAY COMPANY, Peekskill, N. Y., capital stock $150,000, has been incorporated to build and operate a road four miles long in Cortlandt, Yorktown and Peekskill. Edgar Peckham, Benjamin Norton, New York City, and H. C. Soap, of Kingston, are interested.

THE CITIZENS' STREET RAILWAY COMPANY OF BATTLE CREEK, Battle Creek, Mich., capital stock $100,000, has been formed to construct and operate a street railway, and to furnish electric light and power. Loren N. Downs, New York City; Hale P. Kauffer and T. N. Rowley, Kalamazoo, Mich., are all interested.

THE WESTLAKE ELECTRICAL MANUFACTURING COMPANY, East St. Louis, Ill., capital stock $100,000, has been incorporated to own and control patents and to manufacture the appliances appertaining thereto; also a general manufacturing business. Chas. T. Westlake, David Biggs, Edw. Sells and Charles Cummings Collins are the incorporators.

THE SINOLOA ELECTRIC LIGHT & POWER COMPANY, Des Moines, Iowa, capital stock $20,000, has been formed to establish an electric light and power plant in the city of Guliacan, Sinoloa, Mexico. Warren A. Drake, Clarence S. Brown, Chicago, Ill., Carlos E. S. Covar, Sinoloa, Mex., and C. E. Hunn, Des Moines, Iowa, are the promoters.

Special Correspondence.

New York Notes.

Office of The Electrical World,
253 Broadway, New York, Oct. 22, 1894.

MR. VICTOR R. BROWNING, of the National Carbon Company, Cleveland, O., was in the city last week, and reports that the concentration of the business of the National Carbon Company in Cleveland is completed. With the facilities now possessed notable advances will be made in the manufacture of carbons.

MR. W. J. MORRISON, who has represented the Fort Wayne Electric Company in the State of New York for the past 7 years, has resigned his position, much to the surprise of his numerous acquaintances, as he is known to be one of the greatest hustlers in the business, in consequence of which he acquired the sobriquet of "Hustling Billy." During his connection with the Fort Wayne Company he sold 436 arcs (Wood system) and 36,600 incandescent lights with dynamo capacity to match, representing a total of about $1,400,000 worth of apparatus.

THE OAKMAN ELECTRIC CO., (recently reorganized) has moved its offices from the fifth floor Electrical Exchange, to Room 414, fourth floor, same building. The business of this young company has grown to such an extent that the old quarters had become entirely too small for the increased business. This company is agent for several good specialties, among which may be mentioned the McNut incandescent lamp, Hornberger transformers, New England snap switch and Cutler-Hammer rheostats and automatic motor starting boxes.

New England Notes.

Branch Office of The Electrical World,
Room 91, Hathaway Building, 620 Atlantic Ave.,
Boston, October 20, 1894.

THE WASHBURN & MOEN COMPANY, of Worcester, Mass., has recently sold a large order of insulated wire to the Cincinnati Street Railway Company, of Cincinnati, Ohio, consisting of some 200,000 feet of "Crown" rubber insulated cable of 500,000 cir. mils cross sectional area.

MR. LEONARD HERBERT DES ISLES, superintendent of the Electric Heat Alarm Company, of Boston, was recently united in marriage to Miss Carrie Lynwood Clement, both of Boston. We present our congratulations to the happy couple and best wishes for a life of uninterrupted happiness.

THE BOSTON MOTOR COMPANY, Boston, which make a specialty of small motors, and especially fan motors and batteries combined, at very economical rates, now control the "Jupiter" Storage Battery, as well as the Curtis primary battery. In the direction of small motors and aluminum fans and experimental services this company offers several attractions to the public.

THE W. S. HILL ELECTRIC COMPANY, of Boston, continues to receive large and gratifying orders for its well-known switches and switchboard apparatus, and their establishment is still running to its full capacity. As is well known, this company devotes especial care and attention to the designing and construction of switches and switchboards, both for isolated and central station work, and Mr. Hill himself is recognized as one of the pioneers in electrical work.

THE COLUMBIA ELECTRIC COMPANY, of Worcester, Mass., is pushing forward at quite a rapid rate, and has been compelled to increase considerably its working force. Manager Coghlin reports business as exceptionally good. It has recently received contracts for wiring the Ruddy Block, the Sawyer Block, the Houghton Block and St. Jean Baptist Hall, all located in Worcester, and all large contracts. The Houghton Block is the first building in Worcester to adopt the interior conduit system.

THE BIBBER ELECTRIC MANUFACTURING COMPANY, of Boston, is doing an excellent business in its new gas-lighting appliances in both the Pendant and Key types of apparatus. It would appear that the "Bibber" electric gas-lighting burner and the "Vigilant" pendant burner are being quickly recognized as notable improvements in gas lighting. It is stated that the regulation of the height and flow of the gas are important features, combined with the simplicity and economy of the devices.

THE ATTLEBORO STEAM & ELECTRIC COMPANY, of Attleboro, Mass., whose station was burned last spring, started up their new plant Oct. 1. The contract for rebuilding the entire electrical equipment was given to the Rushmore Dynamo Works, Jersey City. The station furnishes all the street and commercial lights for the city and surrounding towns, and the station is considered one of the finest in the state. The company did a large amount of special lighting for the Bi-Centennial Celebration of the founding of Attleboro, October 18 and 19. The success of the electrical display was completed by two large Rushmore search lamps.

THE THOMPSON-BROWN ELECTRIC COMPANY, recently organized under the laws of the State of New York, is about to open a store in Boston at No. 97 High street. The incorporators, it is said, include several representative men in the electrical business. Mr. George Thompson, Jr., president, of New York, has been in the electrical railway business for a number of years. Mr. Maybin W. Brown, until lately president of the Brown Electric Company, is treasurer of the new corporation, and has been well known to the fraternity for many years. Mr. Earnest F. Ayrault, of the law firm of Hawksworth & Ayrault, New York, is secretary. Mr. F. E. Pettingell, who is so well known as to require no special mention, will be an element of strength to the new concern. Mr. H. P. Brown, who has been traveling representative of the Brown Electric Company, and is well known on the road in New England, is also identified with this corporation. The Thompson-Brown Electric Company is sole New England agent for The E. S. Greeley & Co., of New York, one of the oldest electrical establishments in existence. This company proposes to have a "house warming" on Thursday afternoon and evening, October 25, to which all their friends are most cordially invited.

Canadian Notes.

Ottawa, Oct. 20, 1894.

MONTREAL.—The extensive use of the bicycle has caused the Montreal Street Railway Co. to consider the advisability of reducing fares to two cents.

VANCOUVER, B. C.—By a majority of ninety-two votes the citizens have decided to borrow $100,000, to erect a civic electric light plant to light the streets and also to supply private consumers.

MONTREAL.—At the recent annual meeting of the Merchant's Telephone Company it was stated that the company has done about three-fourths of the work necessary to put into operation about 800 instruments. This exhausted the capital stock of the company, but the directors subscribed $30,000 more at eight per cent.

MONTREAL.—At the first annual meeting of the shareholders of the Montreal Island Belt Railway Company, it is stated that $550,000, of the $5,000,000 capital stock of the company, has been subscribed, but of this sum $55,000 is paid up. According to a clause in its charter the company cannot begin work until it has deposited $250,000 to its credit in a chartered bank.

OTTAWA, ONT.—A charter has been issued by the Dominion Government incorporating a company consisting of Jacob Dilcher, banker, of Buffalo; James Bampfield, merchants, Niagara Falls; James Cleary, broker, Troy; Henry Steivert and John Harrington, New York, with power to operate offices for the purpose of communicating by telephone and telegraph. The name of the company is The Colonial Telegraph and Telephone Company, with a total capital stock of twenty-five thousand dollars.

QUEBEC.—Official notice is given that application will be made to the provincial legislature, at its next session, by the Hon. Louis Tourville, of Montreal, and others, for an act to incorporate them as the South Shore Electric Company, with power to construct and operate works for producing electricity for light, heat and power, and to construct electric railways in the counties of Vercheres, Chambly and Laprairie, and upon any bridge connecting the said

counties with the north shore of the River St. Lawrence: to acquire and maintain water works in any of the said counties, and to do all such things as may be necessary or incidental to any of the said objects.

TORONTO.—The Fire and Light Committee has decided to recommend the Council to accept the tender of the Toronto Electric Light Company, for lighting the streets at the rate of $72.82½ per light per annum. Chairman Stewart announced that, according to tenders received and the estimate of the City Engineer, the annual charges of a municipal electric lighting plant would be $100,595. Allowing four per cent. for interest and six per cent. for depreciation, which amounts to $25,300, and putting the running and maintenance expenses down at $75,295, counting 1,300 lights, the cost of each light per year would come to $77.37 or $2.55 per light more than the tender of the Toronto Electric Light Company.

OTTAWA, ONT.—The amalgamation of the Standard Electric Light Company and the Chaudiere Electric Light Company of this city, under the name of the Ottawa Electric Light Company, has brought about a complete reorganization of the directors and staff. The officers of the company are: President and general manager, T. Ahearn; secretary-treasurer, G. S. McFarlane (formerly with the Standard Company); general superintendent, A. A. Dion (Chaudiere Company); chief accountant, D. R. Street (Chaudiere Company). The company now possesses five power-houses, four of which are water power and one steam power. The combined capacity of the dynamos now in position is 35,000 incandescent lights, and 500 arc lights. The steam plant is only used occasionally, and is particularly in demand during the anchor-ice period in the fall and spring.

ENGLISH NOTES.

(From our own Correspondent.)

LONDON, October 10, 1894.

ELECTRIC COAL CUTTING.—A new colliery will shortly be opened in the midlands, under American management, and it is announced that it will be electrically worked throughout. Hitherto, owing to the disinclination of managers to make proper arrangements for carting away the coal cut, and the natural dislike of the men to be superceded by machinery, the electric coal cutter has not had fair play in England. Now that several new collieries are being opened up, it may therefore be hoped that electricity will be adopted from the start, and will be allowed to show what it really can do if it is allowed to do all it can.

ELECTRICAL UTILIZATION OF WATER POWER.—To-morrow the Worcester Municipal Electric Lighting Station will come into operation. This station is interesting as being the first of its kind, that is to say, the first station of any size in which water power has been utilized. For England, the city of Worcester is peculiarly favorably situated in respect to water power. This, however, is the result of trying to use English water power. The Town Council has been obliged to erect its station some three miles outside the city and to construct large storage works, etc. Yet the drought in summe. and the floods in winter necessitate that the turbines should be supplemented by an equal steam plant. It is therefore obvious that very little can have actually been gained by making use of the water at all. Another point of interest in the Worcester station is the fact that the mains from the power house to the town are on the Brooks oil system.

A BIG BREAK-DOWN OF THE CITY ELECTRIC LIGHTING.—The city was visited yesterday by a fine specimen of the London fog from sunrise to sunset, with the result that the City of London Electric Lighting Company probably had the heaviest and most continuous load that it has as yet had to cope with. A viciously inclined exciter switchboard took a mean advantage of this circumstance to make earth, with the result that the field of two alternators was short circuited, with the further result that the remaining machines of the station proceeded to pump heavy currents into the armatures. In order to ascertain the exact extent of the damage done, and to prevent a recurrence of this untoward mishap, the entire station was shut down for some thirty minutes at the busiest hour of the day and some 60,000 to 80,000 lamps were extinguished. I do not know whether busy city men will be mollified on learning that the switchboard in question was only a temporary contrivance. It is needless to say that the gas companies rejoice greatly.

TELEPHONE RECEIVERS IN THE LAW COURTS.—It is generally expected in legal circles that the term of office of the new Lord Chief Justice will be marked by many useful innovations calculated to startle the ultra-conservative legal mind. The first innovation of the Lord Chief Justice, which has been made public, is certainly one calculated to fix attention. Three telephone receivers are to be fitted in the Lord Chief Justice's court, one on the bench, one at the bar, and one near the witness box, with a view of enabling eminent solicitors and eminent counsel to give at least oral attention to the various cases in which they happen to be simultaneously concerned. The multiplicity of cases which a fashionable counsel considers it compatible with the interests of his clients to take up at one time, has long been a source of just complaint among litigants, who complain that instead of securing the entire services of the aforesaid fahionable counsel, they frequently only get a fraction. It would seem as if the innovation of the Lord Chief Justice would still further reduce the numerator of this traction.

THE BOARD OF TRADE ELECTRICAL STANDARDIZING LABORATORY.—After a long delay the Electrical Standardizing Laboratory of the Board of Trade may be said to have come into operation. It is externally a very humble concern, and internally extremely small. The laboratory consists of six rooms in the basement of an old house, close to the Houses of Parliament, belonging to the Board of Trade. One room is occupied by a gas engine and the dynamo which charges the secondary batteries, from which all the necessary power is derived. Another room is occupied by the batteries themselves. The third room contains the standards of current and pressure. The fourth room contains the transformer machines for converting the low pressure continuous current from the accumulators into high pressure continuous or alternating currents as may be desired. The fifth room contains the standard of resistance, and is devoted to electro-motive forces. The last room is devoted to the verification of commercial instruments of all kinds. The accumulators in use consist of a battery of four large Crompton-Howell cells, which are used two in parallel for the direct production of large currents, and a battery of 108 E. P. S. cells. The large cells can supply current of 2,000 amperes for a short time. In the room containing the standards of current and pressure there are arranged on a slate shelf five magnificent "Kelvin" balances capable of measuring currents from 1 ampere up to 2,500 amperes. The standard current balance is an elaborate structure placed on a stone pedestal in the centre of the room. It consists of a sensitive balance suitable for the weights up to five kilograms, with beam arms 16" in length, from which scale pans are hung. Under the end of one arm there is a hollow cylinder of white statuary marble, on the outside of which two circular grooves are cut near the top and near the bottom. Into these groves two coils are wound. Each coil consists of 16 turns of No. 18 S. W. G. wire per layer, and there are 16 layers in each coil. A circular coil is suspended inside the cylinder from one end of the beam arm by means of three gilded wires .086 cent. diameter. Connection is made with the supended coil in the following manner. The ends of the coil are brought out near each other and a considerabe length of wire is allowed for each end, and is formed into a spiral, and then projected horizontally into the centre of the coil where are situated the terminals of the leading-in wires, the wires from the coil being connected to this terminal by fine flexibles. The transforming machinery consists of a continuous current motor and an alternator with shafts in line and both keyed to the same pulley. The batteries supply current to the continuous current motor, and the alternator can be made by means of various transformers to supply currents up to 500 amperes, and pressures up to 10,000 volts. The motor can also be made to drive a continuous current high-pressure dynamo. It is needless to add that all the rooms containing standards are kept at a constant temperature.

News of the Week.

TELEGRAPH AND TELEPHONE.

ASHEVILLE, N. C.—Address J. M. Ingle with prices of telephone supplies.

ROCK HILL, S. C.—Address A. R. Smith concerning contemplated erection of a telephone exchange and line.

SALISBURY, MD.—The Wicomico Falls Milling and Electric Company wants information in regard to telephones for a local exchange.

CEDAR RAPIDS, IOWA.—The Cedar Rapids Telephone Company was recently granted a twenty-five year franchise by the City Council.

WILSONVILLE, ALA.—J. C. Jackson & Sons are in the market for telephone supplies, and desire estimates of cost of telephone systems for line six miles long.

WHEELING, W. VA.—The City Council of Wheeling has passed resolutions compelling telephone and telegraph companies to place their wires underground.

POYSIPPI, WIS.—The Badger Telephone Company was organized with a capital stock of $2,000. A telephone line between this place and Berlin will be built and the new company will then control a direct line from Berlin to Waupaca, with several short branches. The officers of the new company are H. A. McWain, president; V. A. Barr, treasurer; John Boysen, secretary.

SCOTTSBURG, IND.—The citizens have incorporated a telephone company, and within forty days the town will be in communication with Lexington, Ind. Madison and the Falls cities, and will have connection by long distance telephone with Indianapolis, Cincinnati and Chicago. Ezra Thomas is president, and George V. Cain secretary.

ELECTRIC LIGHT AND POWER.

ATHENS, MICH.—The subject of electric lights is being agitated.

BARNET, VT.—An electric light company has been organized here.

CRESTLINE, OHIO.—Crestline has voted not to establish an electric light plant.

JACKSONVILLE, ALA.—The Jacksonville Oil Mill Company will buy an electric light plant.

RICHMOND, VA.—The city is considering the question of constructing its own electric light plant.

SHELBYVILLE, IND.—Frank L. Nukolls has been appointed receiver for the Indiana Water & Light Company.

DULUTH, MINN.—Two hundred citizens of Duluth Heights have signed a petition asking for electric lights.

SUMMIT, N. J.—The Town Committee is considering the question of granting a franchise to light the city by electicity.

PITTSBURG, PA.—Fire damaged the electric light station of the Allegheny County Light Company to the extent of $30,000.

GERMANTOWN, O.—An ordinance is before the Council to provide for the issue of $8,000 in bonds for an electric light plant.

WAUPACA, WIS.—The Waupaca Common Council has granted a twenty years' franchise to the Waupaca Electric Light Company.

ANAHEIM, CAL.—An election will be held on Oct. 27th to decide whether or not the city will issue bonds for an electic light plant.

APALACHICOLA, FLA.,—The City Council is considering the erection of electric light plant and water works. Address the Mayor.

ST. PETESBURG, FLA.—The Williams Ice Company, St. Petersburg, Fla., wants estimates on a 500 incandescent electric light plant, complete.

MARION, OHIO.—The stockholders of the Marion Electric Light and Power Company have voted to increase the capital stock from $40,000 to $100,000.

TREMONT, PA.—The electric light plant will be ready for operation about November 15. The Mansion House is being converted into a power-house.

CHICAGO, ILL.—The Mutual Electric Light Power Company has been granted a permit to erect a power house on 89th street. This power house is to cost $70,000.

LYNCHBURG, VA.—The City Council has decided, by a vote of eight to seven, to appopriate $60,000 in bonds for the erection of an electric light plant. Address the Mayor.

PALATKA, FLA.—The Palatka Light, Power & Supply Company, Box 207, Palaka, Fla., will need one or two 25-kw dynamos, 110-volt lamps, wire insulators, arc lamps, etc.

WYTHEVILLE, VA.—The town owns a municipal light plant which has not sufficient capacity to furnish all the needed lights. Frank Owens is chairman of the Light Committee.

TORONTA, CANADA.—At the meeting of the Parks and Gardens Committee it was decided to recommend the purchase of an electric light plant for the Island at a cost of $1,275.

BUFFALO, N. Y.—A new building is to be erected at the southwest corner of Elliott and Carroll streets, Wells, Williamson & Co., owners. The building is to have an electric plant.

NORFOLK, NEB.—At the general election the city council will vote on a $20,000 bond proposition for the purpose of purchasing the electric light plant and making additions thereto.

KINGSTON, N. Y.—The contract for city lighting has been awarded to Geo. F. Woolston, 40 Wall street, New York. The machinery for this plant will be purchased from the Wall street office.

HULL, MASS.—The town has purchased the plant and franchise of the Hull Electric Lighting Company, and taken posse-sion of the property. The town bonds to pay for the same have been floated.

JACKSONVILLE, FLA.—The contract for the city's own electric light plant was awarded to the General Electric Company, of Atlanta. The plant complete will be put in by this company, and cost $72,850.

BOSTON, MASS.—The Everett Aldermen appointed Aldermen Dyer, Cate and Jennings members of a joint special committee to investigate the report on the feasibility of establishing a municipal electric light plant.

LAWRENCEBURG, KY.—A stock company will be organized for the purpose of establishing an electric light plant, same to be in operation in about a month. G. L. Hogan, of Chicago, Ill., is at the head of the project.

KEY WEST, FLA.—The Key West Light & Power Company has been incorporated, with a capital stock of $125,000, its purpose being to operate an electric plant. John J. Philbrick is president, Geo. W. Allen, secretary, and Jos. C. Whalton, Jr., treasurer.

SACRAMENTO, CAL.—The Sacremento Power & Light Company has closed a contract with the General Electric Company for an equipment to transmit electricity generated by a water power at Folsom, 20 miles distant, for the purpose o supplying light, heat and power to Sacramento.

ALTON, ILL.—The electric lighting company and street railway company have consolidated. Powerful machinery is soon to be placed in the new plant, and within six weeks electric power, as well as light, will be furnished to all who desire it. George Beck is superintendent.

ABBEVILLE, S. C.—A charter has been issued to the Abbeville Light, Water & Power Company, with a capital stock of $30,000, its purpose being to supply the city with light and water. The incorporators are J. S. Cothray, P. Posenberg, W. C. McGowan, G. A. Visanska and others.

EVERETT, MASS.—Aldermen Dyer, Cate and Jennings have been appointed on the part of the upper board, to join with a committee from the lower board, to inquire into the cost of erecting a lighting plant; also to find the price that the Malden Electric Company will ask for their lines.

ANN HARBOR, MICH.—Sealed proposals will be received at the City Clerk's office, Dec. 1st, 1894, for lighting the streets of the city of Ann Arbor with 91 arc lights of 2,000 candle power, to run from sundown to 12.30 a. m., on Philadelphia schedule of moonlight lighting, contracts to run for one year. W. J. Miller is City Clerk.

TERRE HAUTE, IND.—The time for receiving bids has been extended. Sealed proposals will be received by the Common Council until November 6, for lighting the city with electricity according to plans and specifications on file in the office of the said City Clerk. The number of lights now used is 360. Bids will be received for one, three and five years. Charles H. Goodwin, City Clerk.

The Electric Railway.

NATICK, MASS.—The Natick & Cochituate Street Railway Company will extend its line to Natick.

MALDEN, MASS.—The Malden Electric Co. desires to increase its capital stock from $150,000 to $250,000.

ATCHISON, KAS.—Topeka and St. Joseph capitalists propose to build a trolley road between Atchison and St. Joseph.

BAR MILLS, ME.—An electric road from Bar Mills to West Buxton is an assured thing, say the citizens of that section.

ST. AUGUSTINE, FLA.—The St. Augustine Electric Railway Company has secured a franchise for constructing its road.

BOSTON.—The West End Street Railway has been forbidden to carry freight on its cars in this city by the Board of Aldermen.

CARTERVILLE, MO.—Chicago parties, represented by Frederick Fitch, propose building an electric railway from Carterville to Carthage.

INDIANAPOLIS, IND.—The Broad Ripple Rapid Transit Company has decided to build a new power-house at Broad Ripple in the spring.

CINCINNATI, O.—The Board of Aldermen has being petitioned for a franchise for extension of the lines of the Consolidated Railway Company.

DELAVAN, WIS.—The Delavan Electric Lighting & Railway Company is seeking a franchise for an electric road. E. J. Brundage is interested in the project.

EAST SYRACUSE, N. Y.—The Syracuse & East Side Railway Company has drawn plans for a large power-house at East Syracuse, to be completed by December 1.

NASHVILLE, TENN.—The Nashville Traction Company will make extensive improvements to its nine and a half miles of street railway, including new 60-pound rails.

BALTIMORE, MD.—The Clifton Park Passenger Railway Company, just chartered, with a capital stock of $50,000, will erect a power plant to operate its proposed street railway.

NEWARK, N. J.—At the meeting of the Clinton Township Committee the franchise asked by the Consolidated Traction Co. for Freelinghuysen and Clinton avenues was granted.

MONROE, MICH.—President Gardner, of Toledo, Monroe & Detroit Electric Railway, says that the necessary bonds have been placed, and that work on the new road will shortly begin.

SOMERVILLE, N. J.—The New York & Philadelphia Traction Company has abandoned for the present the proposed plan of building a trolley road between this place and New Brunswick.

CINCINNNATI, OHIO.—Bert Baldwin has prepared plans for the erection of a power-house at Langland and Knowlton avenues, to cost $200,000, for the Cincinnati Street Railway Company.

MILTON, MASS.—There was unanimous opposition shown by the citizens to the granting of the petition of the Milton & Boston Street Railway Company for a location in the streets of the town.

WORCESTER, MASS.—A new petition has been received form the Worcester Consolidated Street Railway for permission to lay double track on Belmont street, from Plantation street to the city line.

BATTLE CREEK, MICH.—E. E. Downs, supertendent of the Kalamazoo Electric road has resigned his position and will now construct and manage the Battle Creek line, in which he is financialy interested.

TERRE HAUTE, IND.—The stockholders of the proposed Brazil & Terre Haute Electric Railway will meet this week and elect directors and file papers of incorporation. Considerable stock has been subscribed.

CHICAGO, ILL.—The West Chicago Street Railway Company has obtained a permit to build an electric power house on Western Avenue to cost $120,000 and will also erect a car house on West Madison street which will cost $75,000.

CORTLAND, N. Y.—Surveyors for the electric road have been working between McCrawville and Cortland the past week, for the purpose of determining the most feasible route for the company to reach the former place.

ATLANTA, GA.—The Cotton States and International Exposition has closed a contract with parties who will build an intramural railway to be operated by electricity. It will reach every part of the grounds and will run around the lake.

ELLENVILLE, N. Y.—An Ellenville capitalist is enthusiastic over the project to increase the corporation boundaries of the village so as to take in Napanoch, and an electric railroad between the two villages is proposed. It could be built for $20,000.

NORFOLK, VA.—The Norfolk & Atlantic City Railway Co., of which Jos. T. Allyn is president, has applied to the City Council for a franchise to build a street railway to be operated by electricity or horse power. It is to run to Sewells Point and Veu del Eau.

NEW YORK CITY, N. Y.—On November 6th the citizens will vote on the question whether the credit of the city shall be bonded to the amount of $50,000,000 towards the building of a new elevated railroad from the Battery to the city line beyond the Harlem.

WATERVILLE, ME.—Concerning the rumored extension of the Waterville & Fairfield Electric Railway, a good authority says that nothing definite has been decided upon. Without doubt the road will be built, perhaps this fall, but probably not before next spring.

WEBB CITY, MO.—Messrs. R. A. Johnson, S. Z. Wollower and A. G. Kingsley, of Harrisbug, Pa., who are directors of the Southwest Missouri Electric Railway Company, have returned East after concluding all necessary preliminaries for the extension to Carthage.

TURTLE CREEK, PA.—The borough council met and granted franchises through the borough to two rival street railway companies. The Second Avenue Traction Company is one of the incorporations favored. The ordinance of the Turtle Creek Valley Company was also passed

HAMILTON, ONT.—The Hamilton, Grimsby & Beansville electric railway went into operation last week under the superintendence of Mr. F. E. Handy, who also had charge of its construction. The road is now 16½ miles long and when completed will be 28 miles in length.

WAUKESHA, WIS.—A proposition is to be made by the Waukesha Electric Light Company to furnish power for the new Electric Beach Railway Company. The company proposes to put in a 250-hp engine and a dynamo sufficiently large to cover any extenison that may be made in the road.

FRAMINGTON, MASS.—The Framington (Mass.), selectmen voted to grant a franchise to the Natick Electric Street Railway Company for an extension of its tracks to Ashland an Hopkinton. The tracks are already laid from Hopkinton to Ashland. An endeavor will be made to have the road running this fall.

LOCKHAVEN, PA.—A meeting will be held of citizens of Crawford Township, this county, and of Limestone and Bastress Townships, Lycoming county, to discuss the advisability of constructing an electric railway through those townships to Williamsport. Levi Gann, of this city, is one of the enthusiastic supporters of the enterprise.

PORT JERVIS, N. Y.—The Trustees of the village of Port Jervis have voted, six to three, to grant a franchise for building and operating an electric railroad in the streets of that village, to the company allied to one that is to build a road up the Delaware Valley from Stroudsburg. It is very doubtful if the company will accept the franchise on the terms demanded.

FRANKFORD, PA.—The Delaware and Schuylkill Electric Railway Company has awarded the contract for the new trolley line which will connect Frankford and Germantown, and the work is to be pushed to completion. A feature of the construction will be the use of concrete piers or supports in lieu of modern ties, which is an innovation in this country.

CHICAGO, ILL.—Commissioner Jones has been authorized by the City Law Department to issue the permits asked for by the North and West Chicago Street Railway companies to change a great part of their respective systems from horse to electric power. The applications cover over 100 different streets in all parts of the city. The street car companies expect to get the work under way in about a week.

BEREA, O.—The Cleveland & Berea Street Railway Company is back of a new plan for building an electric railroad connecting Elyria with Cleveland, and the first important step has been taken by L. M. Cor, of Berea, Ohio, who secured a franchise from the county commissioners granting permission for the building of a single track railway, together with necessary side tracks, switches and spurs.

CHICAGO, ILL.—There is a proposition on foot to connect Chicago and Milwauke by an electric railway, and the Lake Shore Electric Railway Company, of Chicago, has been organized for this purpose. John L. Cochran, Clarence Buckingham, Dunlap Smith, D. H. Louderback and Frank P. Hawkins are interested. The capital is $10,000,000. It is understood that the new line will not run into this city, and therefore will not be under the necessity of asking the City Conucil for franchises.

TOWANDA, PA.—It is now said the people who intend building the electric road in Towanda are satisfied with the conditions imposed by the town council. Mr. C. B. Wells, of the electric company, says he will try and get some stock taken this winter. When spring opens they will go ahead and build the road.

IRONTON, O.—Ironton capitalists have formed an electric light and power company and are contemplating putting in an electric street railroad. The capital is $100,000; and the company will apply for a charter at once.

MISCELLANEOUS NOTES.

MR. MAX OSTERBERG, who was graduated from the electrical engineering course of Columbia College this year, has accepted a position as associate editor of "Electric Power" and will also act as one of the instructors in the New York branch of the National School of Electricity.

THE BROOKLYN ELECTRICAL SOCIETY held a regular meeting on Thursday evening, Oct. 18, in the new lecture rooms kindly furnished by the Edison Electric Illuminating Company, at its Central Power Station, 360 Pearl street, Brooklyn. A paper was read by Mr. Thos. A. Bamford, treasurer of the society, on "Telephony Up to Date," illustrated by stereopticon views and apparatus. This is a young society, organized for the diffusion of electrical knowledge, and promises to accomplish a useful end. William Clinton Burling is president, and Arthur A. Fisk, secretary.

THE SPRING GARDEN INSTITUTE, Philadelphia, has prepared a course of forty lessons on electricity which will be taught by Mr. C. W. Swoope on Tuesday and Friday evenings, beginning November 6. Each lecture will last about one hour, and half an hour will then be devoted to giving out problems and answering questions. The following subjects will be taught, and more than half of the time will be devoted to the dynamo and motor and their applications: Electricity, magnetism, galvanic current induction, dynamic current, electric bells, etc., electric lighting, transmission of power, the electric railway, electro-metallurgy, telephone and telegraph, electric heating and modern inventions. The tuition fee will be $5.00 for the course.

THE HENRY ELECTRICAL CLUB, which was the outcome of the course of lectures delivered at Cooper Union last winter in connection with the University Extension, and under the auspicies of Columbia College, has just completed arrangements with the American Institute of the City of New York to become the Electrical Section of the same. Hereafter it will meet every Wednesday evening at the rooms of the Institute, 111-115 West 38th street. The object of the club is to hold informal discussions and have papers on practical subjects presented. In addition, one lecture will be given each month by some specialist on an announced subject. The officers for the ensuing year are: President, W. H. Freedman, E. E.; First Vice-President L. H. Laudy, Ph., D.; Second Vice President, Max Osterberg, E. E.; Secretary, Geoge Whitefield.

THE NIEBUND DEUTSCHER ELEKTROTECHNIKER, of Berlin, has now moved into its new offices at Monbijouplatz, No. 3, and the General Secretary, Mr. Gisbert Kapp, has assumed the management. The question which at the present moment is before the German electrical industry concerns the exhibition to be held next fall at Karlsruhe. This exhibition is intended to bring before the public the advantages of electric power in connection with industries such as are carried on by small concerns or private individuals. For this purpose it is intended to limit the exhibits to tools driven by electromotors and such accessory appliances as may be requisite in the equipment of small workshops with electric power. Hitherto German manufacturers have found electric exhibitions a source of great expense and very little profit, and this experience has resulted in a general disinclination to take part in exhibitions. As, however, an exhibition of the character above described is likely to bring business, the majority of the best firms have decided to take part in it provided they are able, by concerted action, to limit their expenses to reasonable amounts. With a view to attain this result they have agreed to exhibit not individually but through their association.

Trade and Industrial Notes.

THE CORRESPONDENCE SCHOOL OF TECHNOLOGY, Cleveland, O., has recently added to its corps of instructors Mr. R. R. Miller, who recently completed the electrical course at the Ohio State University.

THE CENTRAL MACHINE AND FOUNDRY COMPANY, Quincy, Ill., is having much success with its direct electric elevator, as testified by letters received from those having them in use. The elevator is very compact and all of its parts show careful design.

THE AMERICAN FUEL ECONOMIZER AND ENGINEERING COMPANY, of 136 Liberty street, N. Y., recently furnished an induced draught system to the Electric Traction Co., Philadelphia. It also installed four large economizers which take care of 8,000-hp.

THE INTERIOR CONDUIT AND INSULATION COMPANY, 44 Broad street, New York, has issued a circular and price-list No. 20, devoted to its iron armored insulating conduit. All of the various parts of this system are fully illustrated, and its application shown in several sketches.

BAKER & COMPANY, 121 Liberty street, New York, has issued a third edition, illustrated, of its useful pamphlet entitled "Data Concerning Platinum." The present edition is considerably enlarged over any previous edition and a copy will be mailed to any applicant mentioning the name of The Electrical World.

CHAS. A. SCHIEREN & CO., 45 Cliff street, New York, in their new tannery at Bristol, Tenn., are tanning leather by the old-fashioned process, using pure oak bark, thus producing a material that is especially adapted for leather belting purposes. The capacity of this tannery, which is in the heart of the best oak bark regions, is two hundred hides a day.

EDWARD HARRINGTON, SON & CO., Pennsylvania avenue and Fifteenth street, Philadelphia, calls attention in a pamphlet to their complete system of electric light and power-house equipments for the handling of heavy weights. The different hoists made by this firm are of the capacities from 500 pounds to ten tons. Their traveling cranes are of different types so that every conceivable case can be provided for.

MORRIS, TASKER & COMPANY, INCORPORATED, 222 South 3rd street, Philadelphia, Pa., have been made sole manufacturers of the well-known Duggan adjustable bracket. These brackets are made of wrought iron, and being of the simplest construction are cheaply manufactunred, and the price has recently been further reduced. They may be purchased direct from this firm or from the Burnham & Duggan Railway Appliance Co., Boston, Mass.

THE ELECTRIC APPLIANCE COMPANY, Chicago, reports having secured the Western agency for the celebrated line of electrical railway supplies of the Lynn (Mass.) Manufacturing Company, which includes one of the best railway insulations ever produced, and will carry a large stock in Chicago and be prepared to ship entire equipments from that point. Special catalogue and advertising matter is being prepared and will be ready for distribution very shortly.

THE CENTRAL ELECTRIC COMPANY, Chicago, after having made exhaustive and careful tests of the B. &. S. compounds and paints, will handle this product in the West, as General Western Agents. It reports that it finds the B. & S. products are the highest insulating mediums of their kind on the market, and states that it will carry a large stock in its Chicago warehouse, and has already secured sufficient orders to prove that the trade appreciates the superiority of this product.

THE NEW YORK & OHIO Company, and the Packard Electric Company, both of Warren, Ohio, have each issued an unusually handsome pamphlet, the former under the title of "The Packard Family," referring to an engraved group of incandescent lamps, and the latter devoted to the Packard transformer. Aside from the interesting matter contained, the catalogues are fine specimens of the printer's and engraver's art, and show that it is possible to obtain most excellent results on a small page, contrary to the usual opinion.

THE WATERTOWN STEAM ENGINE COMPANY, Watertown, N. Y., reports the following recent sales of Watertown engines: One 100-hp high speed engine for the Louisville, New Albany & Chicago Railroad; one 100-hp high speed to the Grand Island Light & Power Company, Grand Island, Neb.; one 50-hp direct connected, to the Western Electric Company, of St. Louis; one 100-hp heavy duty engine, for export to Cuba; three small outfits for export to India; one 50-hp high speed, for C. F. Rumpp & Sons, Philadelphia, Pa., second order); one 50-hp Excelsior automatic, to J. Mason Gross, Wakefield, R. I.

MR. ALTON D. ADAMS, Electrical Engineer and Manufacturers' Agent, with headquarters at 43 Fourth street, Troy, N. Y., and 620 Atlantic avenue, Boston, is now handling a full line of electrical machinery, supplies and structural material, among which are charcoal iron stampings for armature and transformer cores, made by Turner Bros., London, Eng., and iron and steel forgings for electrical machinery. Mr. Adams is also about to put on the market a line of forged iron field magnet dynamos and power generators, from 20 to 200-hp capacity, of high efficiency and very light weights for their rated capacities.

THE SIEMENS & HALSKE ELECTRIC COMPANY'S factory, as our readers are aware, was destroyed by a great lumber fire in Chicago, August the 1st. The company made a lease with the Grant Locomotive Works, August 11, commenced moving into the new works August 15, and it finished and shipped the first generator, built entirely at the new factory, Oct. 15th. Every available tool in the new works is now in operation and many of the tools which were destroyed in the fire have been duplicated, so that from now on the company is in a position to finish one direct coupled generator each day. These few simple facts indicate the dauntless spirit of the company and it is certainly to-day in a better condition for competition in the electrical field than before the fire.

THE STUCKY & HECK ELECTRICAL MANUFACTURING COMPANY, No. 23 New Jersey Railroad Avenue, Newark, N. J., reports business to be increasing rapidly. It is especially busy reconstructing railroad motors, commutators and converters, and has just reconstructed two 70-volt Weston dynamos of 125 volts for the new Saenger Hall in Newark, N. J. At present the works are being removed to No. 35 New Jersey Railroad Avenue, opposite Market Street Depot, to a large three-story brick building which will be occupied entirely and where, besides its own direct current testing circuits, the 1,000-volt alternating circuit from the Newark Electric Light Station will be utilized. The Stucky & Heck Company has also undertaken the construction of the Ash automatic electric traction switch, which can be seen in operation at the corner of Broad and Bridge streets, Newark, N. J..

THE ELECTRIC APPLIANCE COMPANY, Chicago, is distributing two little catalogues, which will undoubtedly prove to be of interest, as they are the first separate catalogues published covering the goods which they list. The one is a complete catalogue of the Packard transformer illustrating and describing the process of manufacture and the detail of construction and giving data in regard to efficiency, regulation, etc. This is the first complete catalogue of the Packard transformer that has been issued. The other catalogue covers the complete line of Packard lamps from the "Baby" to the "Mogul" with special appliances that have been designed by the Packard Company and manufactured solely by them for use in connection with their Mogul and other special

lamps. This catalogue lists for the first time the Packard theatre lamp, a special lamp for foot, border and bunch lights; the Packard stereopticon lamp (a substitute for calciums for theatrical work), and the focusing outfit for use in connection with same. In fact both of these catalogues are filled with information that will be entirely new to the majority of the trade.

HOUSTON, STANWOOD & GAMBLE, Cincinnati, Ohio, have opened an office in St. Louis under the management of Mr. A. Schen. The following is a list of those to whom standard engines made by this company have been sold since August 1. The Stratton-White Co., (two engines), Fort Worth, Texas; Pierce & Miller Engineering Co., (four engines,) New York, N. Y; Harvard University, Boston, Mass.; Pleasant Valley Paper Co., Middletown, O.; O'Harra Bros., Dalton, Fla.; W. O. Sugg, Hales Point, Tenn.; Wyoming Light, Heat, Water & Power Co., Wyoming, O.; E. E. Harrell, Sunsbury, N. C.; R. H. Wood & Co., Lorain, O.; American Sugar Refining Co., Boston, Mass.; Orange Lumber Co., Orange, Texas; S. B. Hornsby, Frogmore, La.; Grand Rapids Veneer Works, (two engines), Grand Rapids, Mich.; American Tool & Machine Co., Boston, Mass.; Oliver Davis, Tyronza, Ark.; John H. Herald & Co., (two engines), Lynchburg, Va.; Craig Lumber Co., Knoxville, Tenn.; Memphis Gin & Machine Co. (three engines), Memphis, Tenn.; Baker Bros., Dyersburg, Tenn.; Herring-Hall-Marvin Co., Cincinnati, O.; Laidlaw-Dunn-Gordon Co., (two engines), Cincinnati, O.; Cedar Point Seminary, Cincinnati, O.; Thompson Coal Co., (two engines), Aetnaville, Ky.; Licking River Rolling Mill Co., Covington, Ky.; Fairbanks, Morse & Co., Denver, Col.; H. P. Gregory & Co., (two engines,) San Francisco, Cal.; American Cooperage Co., Friar's Point, Miss.

THE HUBLEY MANUFACTURING COMPANY, of Lancaster, Pa., is rapidly coming to the front, and is occupying a prominent position among its competitors in the electrical field. It is located at Lancaster City, in the eastern part of Pennsylvania, a location as central as could be desired and is nicely settled in its new plant, a mile from the center of the city on the Pennsylvania Railroad, branches of which lead into the works. With its iron and brass foundries, employing nearly one hundred moulders; machine shops, grinding, polishing and nickle plating buildings and warehouses, all equipped with new machinery of the latest and best patterns, employing over three hundred hands, it has one of the most complete and best appointed plants in the state. On account of its rapidly increasing business, however, it finds it necessary to erect at once a new foundry building, which will give employment to nearly one hundred more moulders; and also to erect a large two-story building for manufacturing purposes. The company manufactures a full line of overhead street railway material, using the celebrated Medbery insulation. Its line of ears, straight line, anchor, feeder and splicing ears, are of new design and are both light and strong, and are made to solder on; a complete line is also made to hammer on, a feature which is being demanded by a number of managers on large roads. It is the sole manufacturers of the Cope come-along, which is one of the most useful tools in construction work, and has been greatly improved, a ring being introduced at the end, instead of a hook, as in the old form, making them stronger. The jaws are slightly curved on their bearing surface and have a checked grooving, instead of being straight and having a filed grooving as in the old form. This ensures a firmer grip on the trolley wire and is less liable to drop. In the construction department it has several large contracts on hand, among the most important may be mentioned the contract for forty-three miles of electric railway for the Pennsylvania Traction Company, a fifty-mile telephone line, and the equipment of an electric lighting plant of one thousand lights capacity.

Business Notices.

BATTERY CUT-OUT, CHEAP.—Sensitive, reliable, never requires attention. Gas lighting much improved by its use. Electric Supply Company, of 105 South Warren street, Syracuse, N. Y.

TO WHOM IT MAY CONCERN.—Take notice that the co-partnership existing under the firm name of Bradley & Combs, doing business at Rochester, N. Y., has been mutually dissolved.

THE AMERICAN RAILROAD IMPROVEMENT COMPANY, 95 Milk street, Room 15, Boston, is desirous of obtaining a few first class franchises and contracts to build and equip electric railroads Part payment taken in bonds.

Illustrated Record of Electrical Patents.

UNITED STATES PATENTS ISSUED OCTOBER 16, 1894.

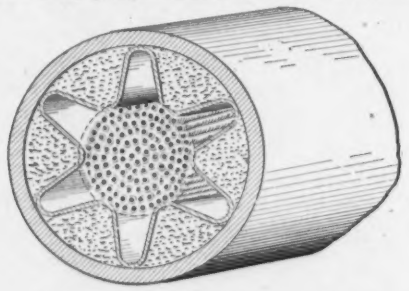
(In charge of Wm. A. Rosenbaum, 177 Times Building, New York.)

527,601. CONDUIT ELECTRIC RAILWAY.—O. B. Finn, Philadelphia, Pa. Application filed March 16, 1894. This comprises a box adapted to hold the circuit-forming mechanism mounted on bearings, whereby it may be turned upwardly.

527,559. ELECTRIC ARC LAMP; A. H. Moses, St. Louis, Mo. Application filed January 21, 1893. A lamp having an air-tight connection between the casing and the globe.

527,297. UNDERGROUND CONDUIT; J. E. Edwards, Toronto, Canada. Application filed June 7, 1894. This comprises outer pipe sections, inner supporting racks having projecting flanges, the racks and pipe sections being provided with openings for the purpose of making the connection with the wires.

527,730. THEOSTAT; A. J. Shaw, Muskegon, Mich. Application filed March 15, 1894. This consists of a metallic band folded back and forth in short lengths in two or more groups, insulating blocks between the groups and be-



NO. 527,414.—ELECTRIC CABLE.

tween the folds of each group, and binding bands passing about the groups and serving to hold the same in a compact body.

527,546. TROLLEY; W. H. Bache, Bound Brook, N. J. Application filed October 31, 1893. This comprises a support, bracket and wheel, a pivoted contact arm and an operating cord.

527,518. SECRET TELEGRAPHY; A. D. P. Weaver, Jackson, Mich. Application filed December 26, 1893. This comprises a rheostat and key, an extra relay, an extra sounder, an ordinary relay and sounder and a battery for the local circuit.

527,501. MULTIPLE SAFETY CUT-OUT; J. F. McLaughlin, Philadelphia, Pa. Application filed January 18, 1890. This consists of a series of easily fusible conducting strips, a spring actuated switch adapted to include any one of the strips in the circuit, a hand-switch also included in the circuit and a detent in operative relation to both switches, whereby the spring actuated switch is locked when the circuit is opened by the hand switch.

527,528. ELECTRIC CLOCK; C. Gullberg, Jersey City, N. J. Application filed September 16, 1893. The combination of an electro-magnet, a pendulum subjected periodically to the pull thereof, a ratchet wheel actuated by the pendulum, a circuit closing switch and switch releasing lever, the lever periodically subjected to a stud on the ratchet wheel, and the wheel adapted for actuating the time train.

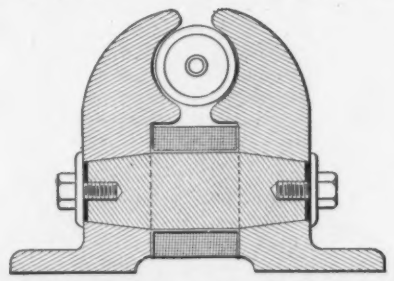
527,556. WEATHER PROTECTING COVERING FOR ELECTRICAL CONDUCTORS; E. J. Houston, Philadelphia, Pa. Application filed November 17, 1891. The combination with a contact wire, of a thin, pliable, continuous, adhesive, permanent, weather protecting coating of carbon, substantially integral therewith.

527,415. DYNAMO ELECTRIC MACHINE; E. Fawcett, Alliance, Ohio. Application filed February 15, 1894. The combination of a field piece having a tapering end and a polepiece having a tapering opening to receive the tapering end of the field piece.

527,461. APPARATUS FOR SIGNALLING THE APPROACH OF STREET CARS; G. B. St. John, Kalamazoo, Mich. Application filed November 27, 1893. This comprises a group of signals connected by a single wire, and a circuit closer operated by the car.

527,436. PRIMARY BATTERY AND PORTABLE ELECTRIC LAMP; S. W. Maguay, London, England. Application filed January 4, 1894. This comprises the cells, a frame, insulated rods attached to the frame, a liquid tight plate carrying stuffing boxes through which rods pass, and zincs in the form of plates carried on the flat by the rods.

527,481. TREADLE FOR USE IN RAILWAY SIGNALLING; J. G. Dixon,



NO. 527,415.—DYNAMO ELECTRIC MACHINE.

Birkby, England. Application filed February 20, 1894. The combination of a depressible treadle, and counterbalanced and pivoted lever, of a dash pot cylinder, piston, and piston rod connecting the lever and piston, an insulated contact piece normally above the piston in the cylinder, and two conductors connected respectively to the contact piece and cylinder, the circuit being completed by the ascending piston.

527,414. ELECTRIC CABLE; T. J. Dewees, Palmyra, N. J. Application filed June 20, 1894. The combination of a metallic cable formed of flexible conductors, and inclosing irregular sheath of paper or fibrous material secured about the cable in a manner to form air spaces adjacent to the cable, an inclosing lead sheath or outer tubing, and quick lime contained within the outer head tube and supported by the paper covering of the cable.

527,608. LIGHT INDICATOR. L. F. Johnson, Poughkeepsie, N. Y. Application filed April 17, 1894. This comprises a switch lamp, a thermostatic circuit controller supported in proximity thereto, a battery and magnet, a signal arm carried by the armature of the magnet, a normally open shunt around the circuit closer and magnet adapted to be closed by the release of the armature, and an audible signal included in the shunt.

527,759. TELEPHONE CALL REGISTER; W. T. Gentry, Atlanta, Ga. Application filed April 20, 1894. The combination, with the telephone station instrument of a tumbler adapted to receive a key and having connection with a sounder and adapted, by its rotation, to operate same, and a counting train and dials, the train being connected with the tumbler.